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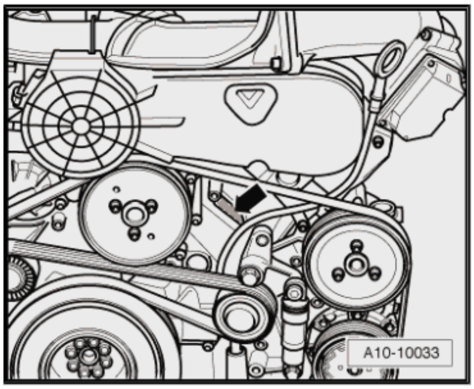
00 – Technical data

1 Engine number

- The engine number („engine code“ and „serial number“) can be found at the front below the toothed belt for the high-pressure pump (left-side) -arrow-.
- There is also a sticker on the intake manifold showing the „engine code“ and „serial number“.
- The engine code is also included on the vehicle data sticker.



Note

On some versions the engine number is concealed by an idler roller for the poly-V belt. Removing idler roller for poly V-belt ⇒ page 56 .

2 Engine data

Code letters		ASB	BNG
Capacity	ltr.	2.967	2.967
Power output	kW at rpm	171/4000	155/4000
Torque	Nm at rpm	450/1400 … 3250	450/1400 … 3250
Bore	∅ in mm	83.0	83.0
Stroke	mm	91.4	91.4
Compression ratio		17.3 … 17.7	17.3 … 17.7
CN	(minimum)	51	51
Firing order		3–6–1–4–2–5	3–6–1–4–2–5
Exhaust gas recirculation		yes	yes
Turbocharging/supercharging		yes	yes
Self-diagnosis		yes	yes
Catalytic converter		yes	yes
Charge air cooling		yes	yes
Lambda control		yes	yes

3 Safety precautions

When working on the fuel system note the following warnings:

WARNING

- *The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*
- *Wear protective gloves.*
- *Wear safety goggles.*

Observe the following points to prevent personal injuries and damage to the injection and glow plug system:

- Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.
- Always switch off ignition before washing engine.
- Faults are stored in engine control unit if electrical connectors have been unplugged:

– Connect vehicle diagnostic, testing and information system - VAS 5051B- .

– Start „Vehicle self-diagnosis“ mode.

– Interrogate event memory.

Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- *Observe notes on procedure for disconnecting the battery.*
- *Always switch off the ignition before disconnecting the battery.*

– Disconnect battery ⇒ Rep. gr. 27 .

When working on the cooling system note the following warnings:

WARNING

Hot steam/hot coolant can escape - risk of scalding.

- *The cooling system is under pressure when the engine is hot.*
- *To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.*

Note the following if testers and measuring instruments have to be used during a road test:

WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

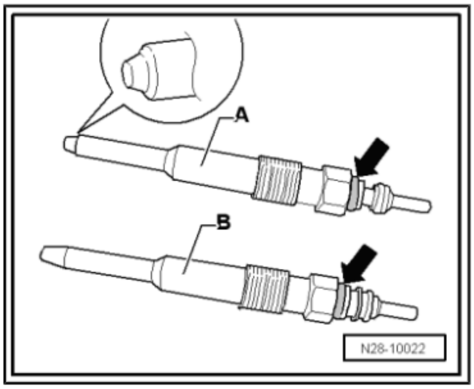
Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*

◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

4 General repair instructions

4.1 Different types of glow plugs for the 6-cylinder 3.0 ltr. TDI engine



Up to autumn 2004, two different types of glow plugs are fitted in the Audi A8 with 6-cylinder 3.0 ltr. TDI engine; from autumn 2004 onwards, these engines are fitted exclusively with metal glow plugs. Distinguishing features:

A - Ceramic glow plugs are colour-coded with a „white seal“ -arrow- and have a chamfered shoulder at the tip.

B - Metal glow plugs are colour-coded with a „red seal“ -arrow-.

The metal glow plugs do not require any special handling procedures.

4.2 Handling ceramic glow plugs

Important: Note the following points regarding ceramic glow plugs:

Caution

- *Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28 .*
- *Transport and store only in original packaging or packed separately in bubble wrap.*
- *Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.*
- *Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).*
- *Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.*
- *Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.*
- *If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).*
- *The software of the engine control unit is specifically adapted to either the ceramic or the metal glow plugs, so it is important to install the correct type.*
- *Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.*

4.3 Rules for cleanliness when working on fuel supply system, injection system and turbocharger

Even small amounts of dirt can cause malfunctions. For this reason, when working on the fuel supply system, the injection system or the turbocharger, please observe the following basic rules carefully:

- ◆ Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- ◆ Plug open lines and connections with suitable protective caps immediately.
- ◆ Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- ◆ When the system is open: Do not work with compressed air. Do not move the vehicle unless absolutely necessary.

4.4 Checking fuel system for leaks

- – Allow engine to run for several minutes at moderate rpm.
- – Switch off ignition.
- – Check complete fuel system for leaks.
- – If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- – Road-test vehicle and accelerate with full throttle at least once.
- – Then inspect high-pressure section of fuel system again for leaks.

4.5 Contact corrosion!

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).

For this reason, only fasteners with a special surface coating are used.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Parts catalogue .

Note the following:

- ◆ We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- ◆ We recommend the use of Audi accessories.
- ◆ Damage caused by contact corrosion is not covered under warranty.

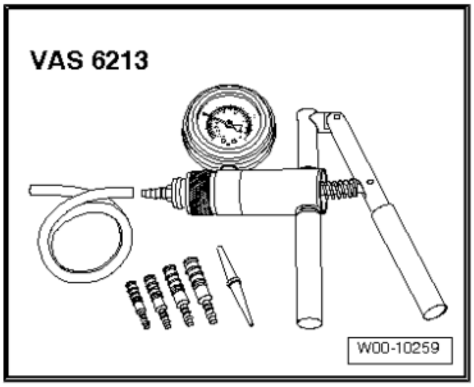
4.6 Installing radiators, condensers and charge air coolers

Even when the radiator, condenser and charge air cooler are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator, charge air cooler or condenser.

4.7 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-



Procedure

- Check all vacuum lines in the complete vacuum system for:
- Cracks
- Traces of animal bites
- Kinked or crushed lines
- Lines porous or leaking
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If a fault is stored in the memory, check the vacuum lines leading to the corresponding component and also check the remaining vacuum lines in the system.
- If it is not possible to build up pressure with the hand vacuum pump -VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

4.8 Routing and attachment of pipes, hoses and wiring

Mark hydraulic lines, vacuum lines and electrical wiring before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.

10 – Removing and installing engine

1 Removing and installing engine

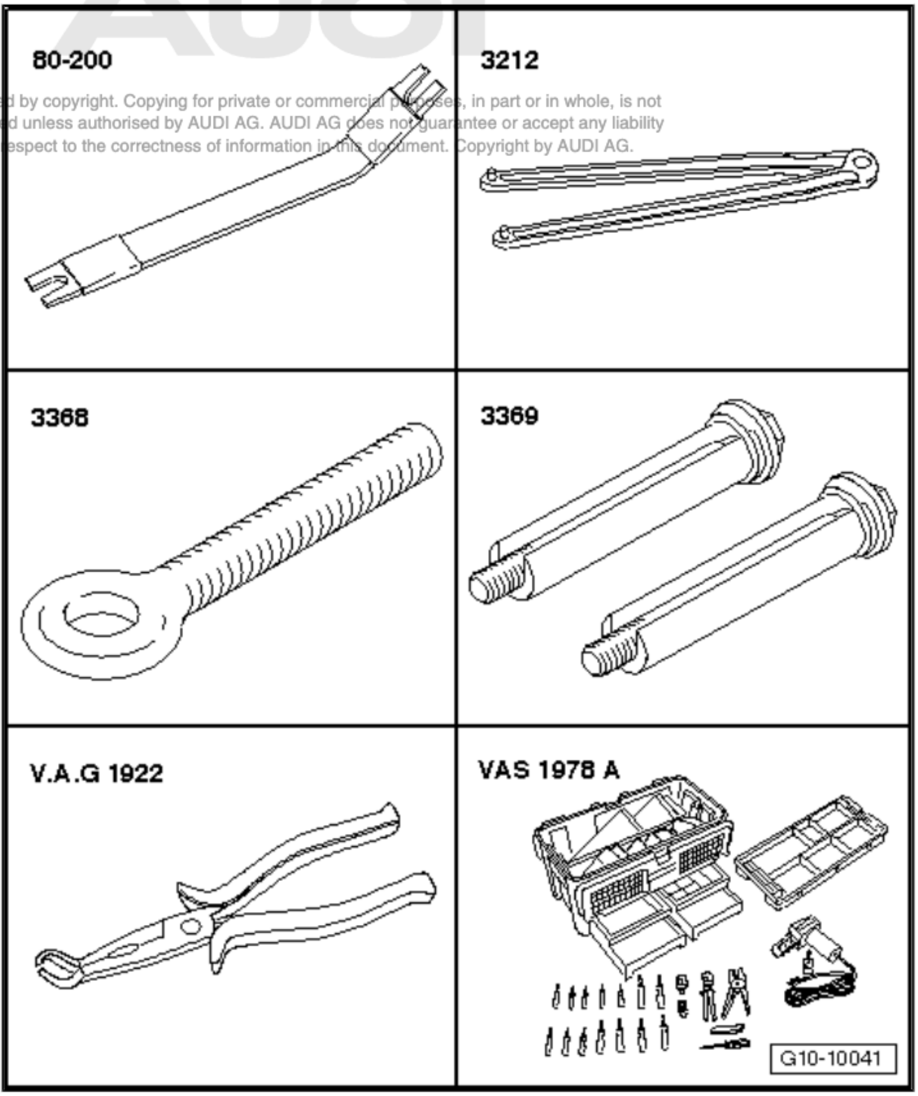
Note

- *The engine is removed from below together with the gearbox and subframe.*
- *Before starting work, make sure you have the following supports available for the scissor-type assembly platform -VAS 6131 A- in addition to the existing engine/gearbox support set: tapered mounting pin -VAS 6131/10-2- (1x), adapter -VAS 6131/10-9- (1x), adapter -VAS 6131/10-12- (2x).*
- *Renew all cable ties which are released or cut open when removing the engine. Refit in the same position when installing the engine.*
- *Collect drained coolant in a clean container for re-use or disposal.*

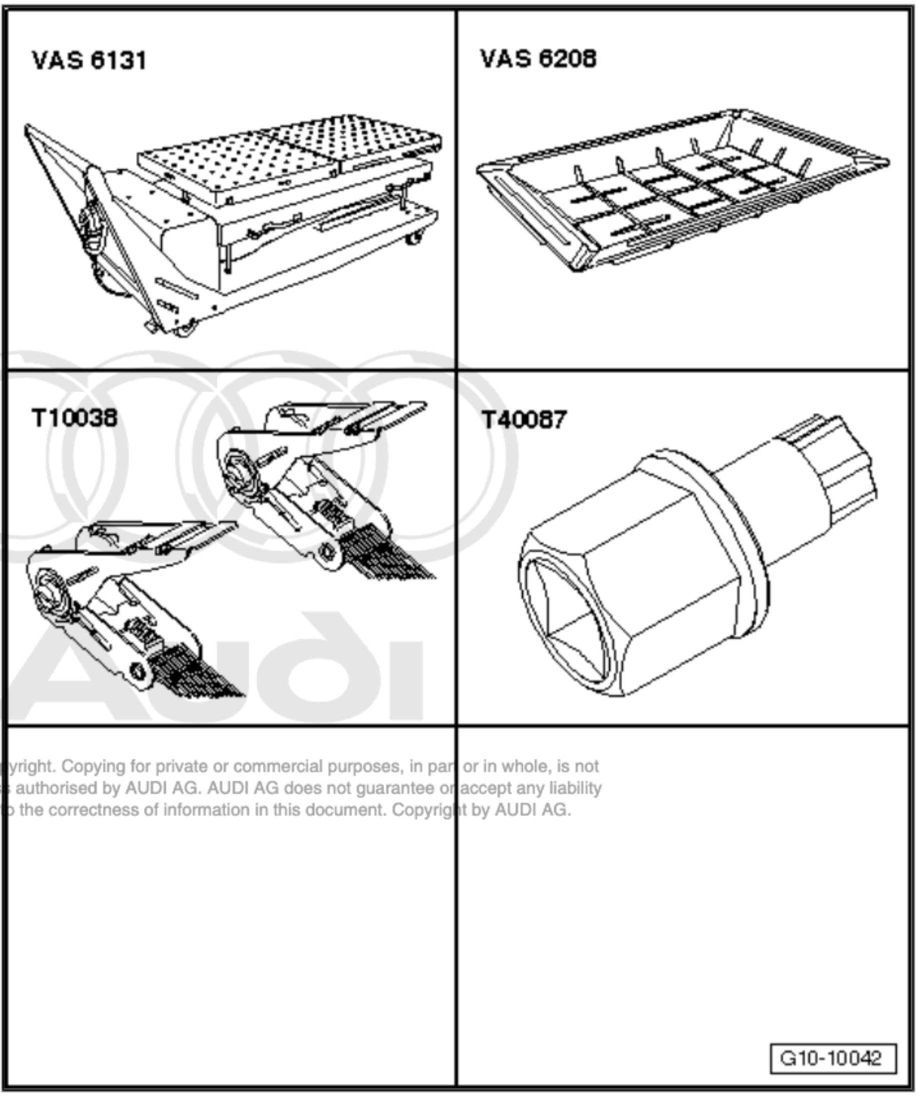
1.1 Removing engine

Special tools and workshop equipment required

- Removal lever -80 - 200-
- Pin wrench -3212-
- Eye-head bolt -3368-
- Front-end service sleeves -3369-
- Spark plug connector pliers -V.A.G 1922-
- Release tool -VAS 1978/8A- from wiring harness repair set -VAS 1978A-



- Scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- and additional tapered mounting pin -VAS 6131/10-2- (1x), adapter -VAS 6131/10-9- (1x), adapter -VAS 6131/10-12- (2x)
- Drip tray for workshop hoist -VAS 6208-
- Tensioning strap -T10038-
- Socket Torx T 60 -T40087-



Procedure

Note

If the engine is going to be separated from the gearbox (after the entire assembly is removed), you will additionally need support set -VAS 6131/11- and adapter -VAS 6131/10-12- .

– Move selector lever to position „N“.

Caution

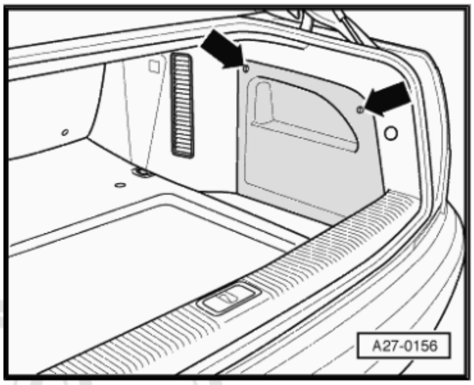
Observe notes on procedure for disconnecting the battery. ⇒ Rep. gr. 27 .

– Switch off ignition.

Note

- *To make sure you can still move the front wheels when the battery has been disconnected, only disconnect the battery with the ignition key inserted.*
- *On four-wheel drive vehicles the electronic parking brake must be released before disconnecting the battery, so that the prop-shaft can be turned during removal.*

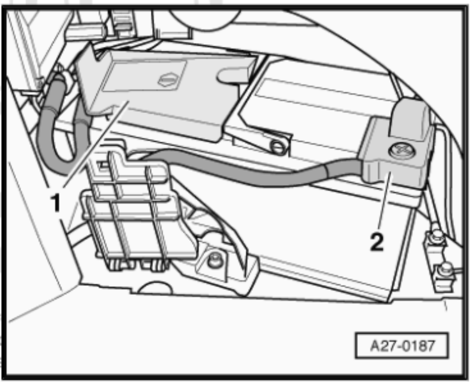
– Remove luggage compartment side trim cover (right-side) -arrows-.



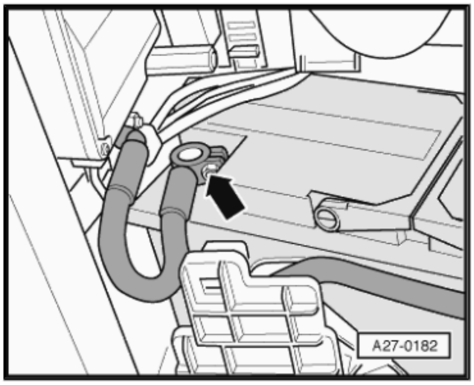
– Remove cover -1- over battery.

Note

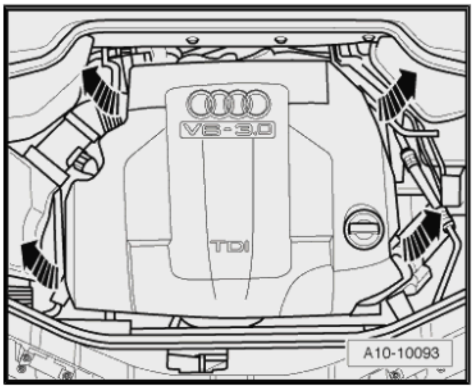
Disregard -item 2-.



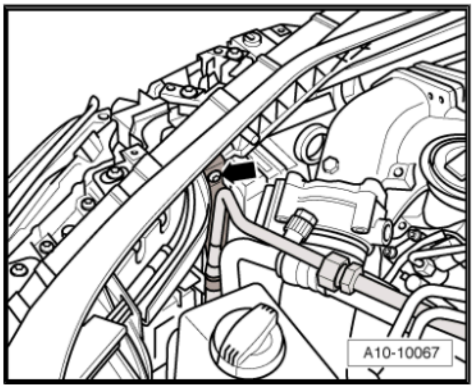
– Disconnect earth cable -arrow- at battery.



- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



- Unscrew bracket for air conditioner pipe from lock carrier -arrow-.



WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

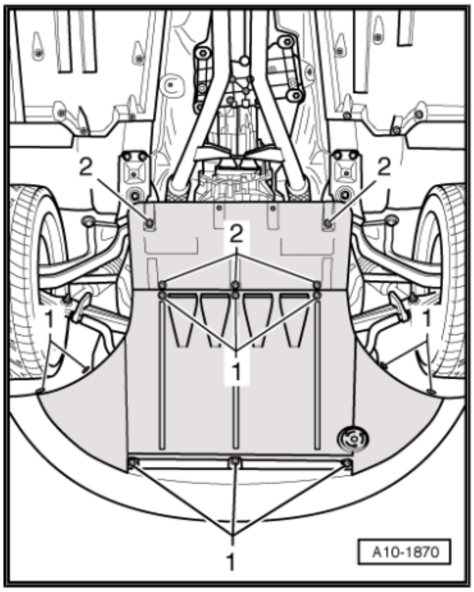
- Open filler cap on coolant expansion tank.

- Remove both front wheels.

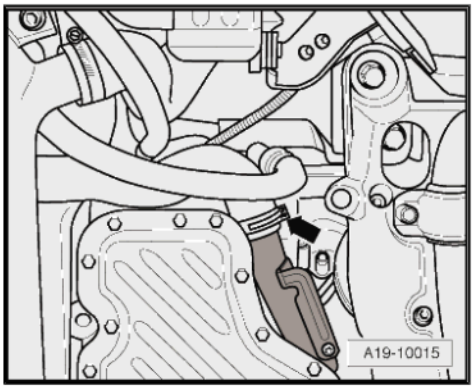
Note

Secure brake discs with wheel bolts.

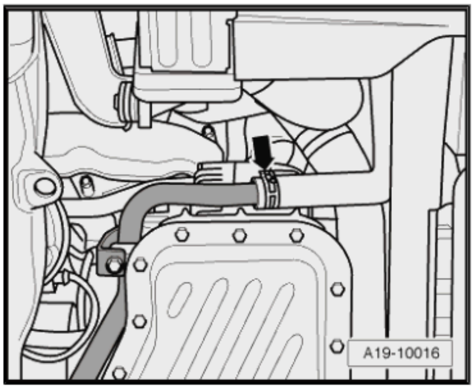
- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.



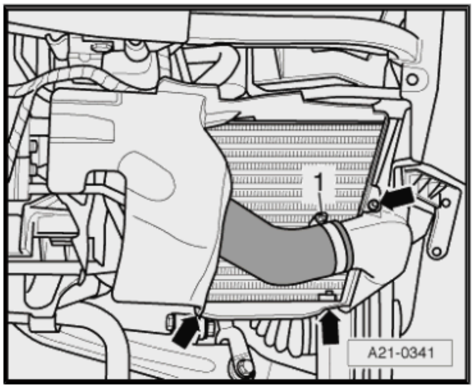
- Place drip tray for workshop hoist -VAS 6208- under engine.
- Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.



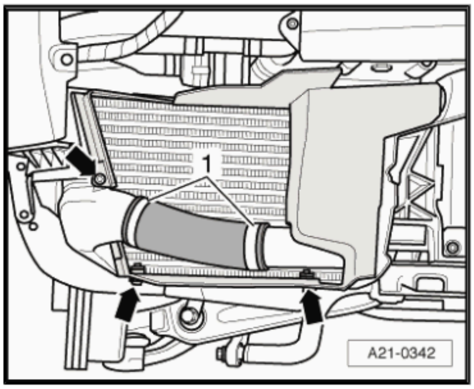
- Disconnect coolant hose -arrow- from coolant pipe (right-side) and drain off remaining coolant from engine.



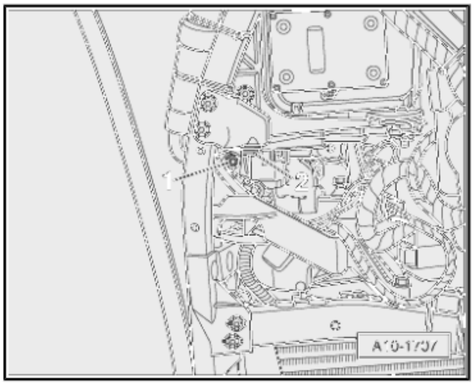
- Remove front sections of front wheel housing liners (left and right) ⇒ Rep. gr. 66 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Open hose clip -1- and disconnect air intake hose.
- Remove bolts -arrows-.
- Detach air duct from charge air cooler (left-side).



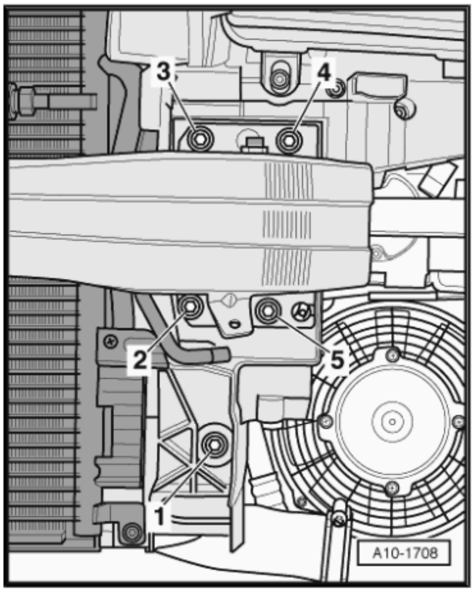
- Open hose clips -1- and disconnect air intake hose.
- Remove bolts -arrows-.
- Detach air duct from charge air cooler (right-side).



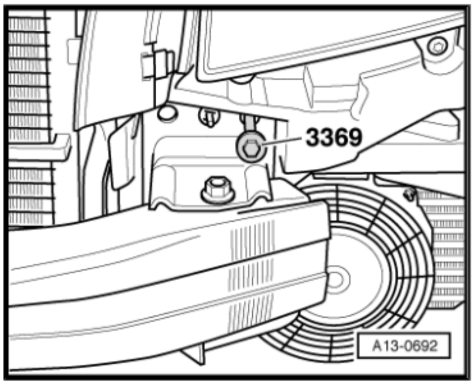
- Working from wheel housing, remove one nut -1- and one bolt -2- for lock carrier on each side.



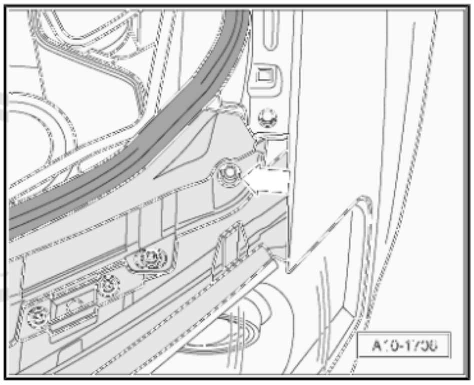
- Unscrew bolts -1 … 5- on both sides of vehicle.



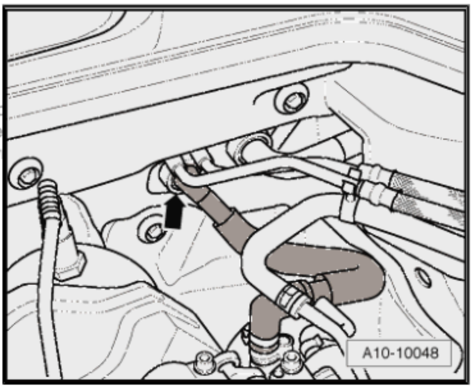
- Remove bolts from front-end service sleeves -3369- (special tool).
- Screw bolts from front-end service sleeves -3369- into top bolt holes for impact damper (left and right sides).



- Pull off bonnet seal at both wing panels.
- Remove one bolt -arrow- on each side from top of lock carrier.
- Carefully pull the lock carrier forward.



- Disconnect vacuum hose -arrow- leading to brake servo.



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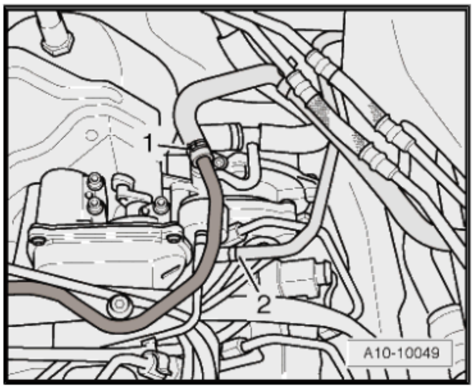
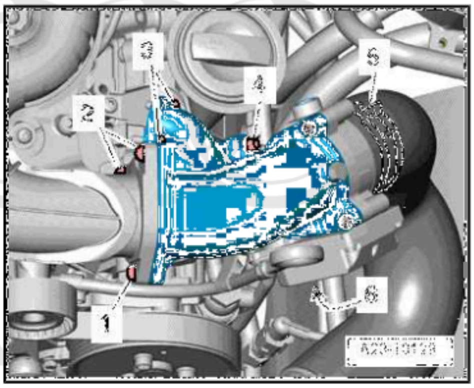
- Disconnect coolant hose -1- and vacuum hose -2-.



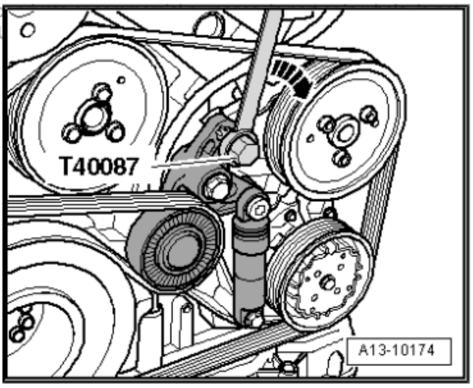
- Disconnect air intake hose -5- from throttle valve module -J338- .
- Unplug electrical connector -6- at throttle valve module -J338- .
- Remove bolts -1 … 4- and take out intake connecting pipe.



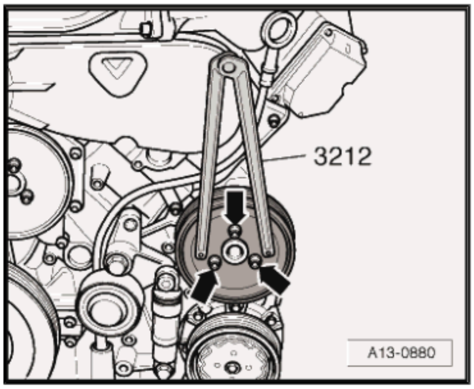
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

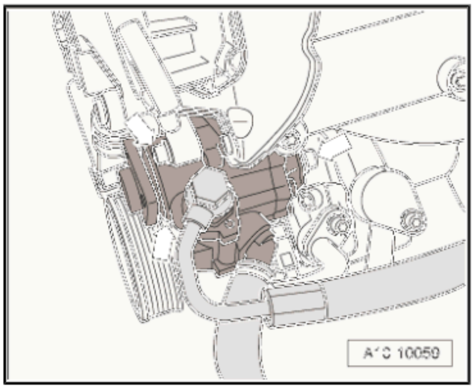
- Slacken poly V-belt by swivelling tensioner in direction of -arrow-, using socket Torx T 60 -T40087- and a long, straight-handled ring spanner or open-end spanner.
- Remove poly V-belt from tensioning roller.



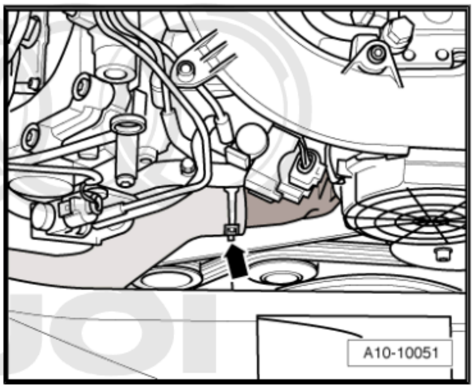
- Unbolt power steering pump pulley -arrows- (counterhold with pin wrench -3212- .



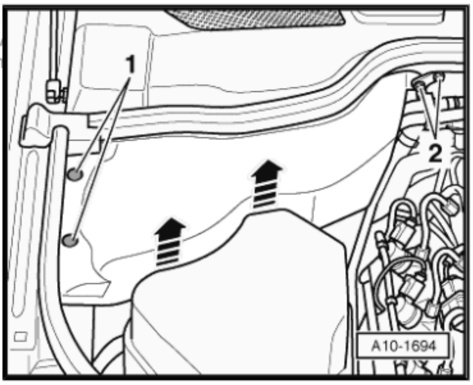
- Unbolt power steering pump from bracket -arrows- and tie up to one side (with pipes/hoses connected).



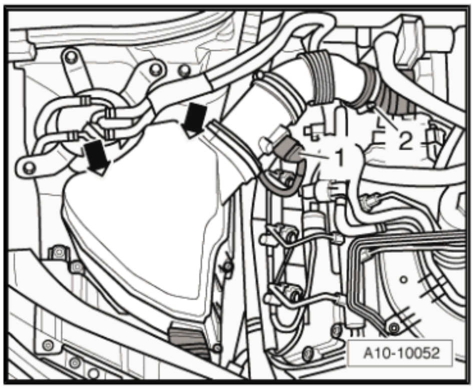
- Disconnect coolant hose -arrow- from hose connection on thermostat.



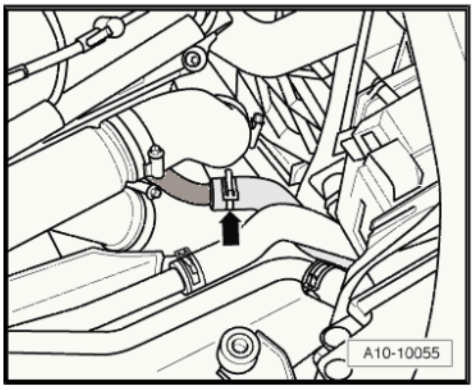
- Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- Pull cover out of retainers -arrows-.



- Detach air intake hose -2- at turbocharger.
- Detach electrical connector at air mass meter -G70- .
- Remove bolts -arrows-.
- Take out air cleaner housing.



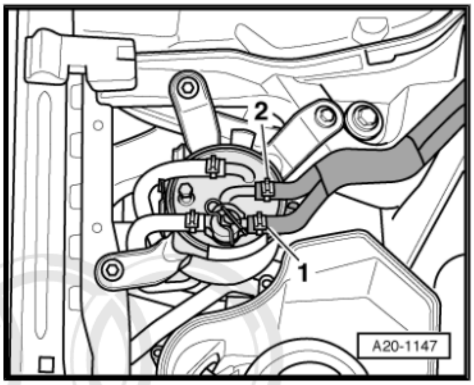
- Detach coolant hose (right-side) -arrow- at engine.



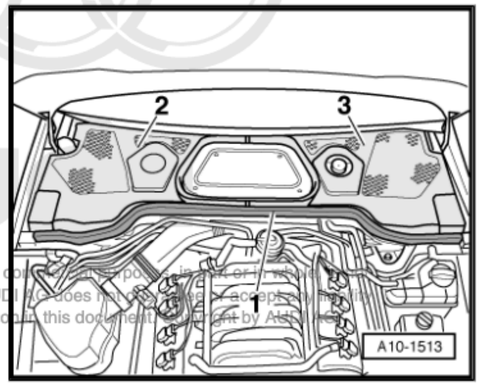
Caution

Rules for cleanliness when working on the injection system ⇒ page 6 .

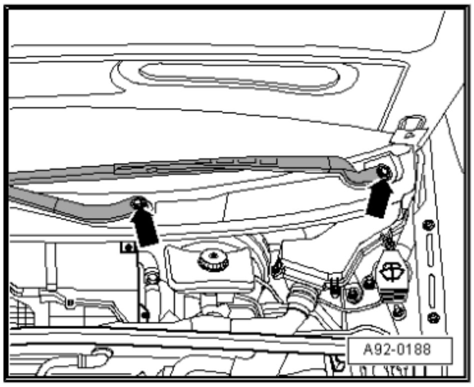
- Disconnect fuel return pipe -1- and fuel supply pipe -2- from fuel filter.



- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.



- Pry off caps on windscreen wiper arms with a screwdriver.
- Loosen nuts -arrows- several turns.
- Tilt windscreen wiper arms one by one and loosen from wiper shafts.
- Remove nuts completely and take off wiper arms.

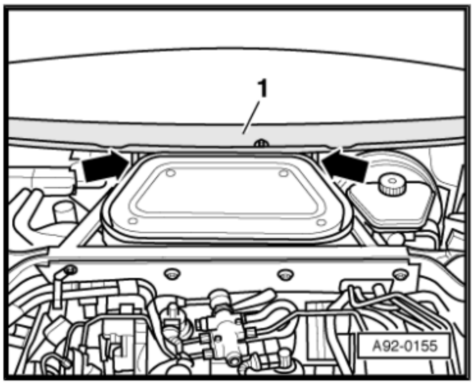


- Remove dust and pollen filter ⇒ Rep. gr. 87 .

Note

Cover air duct at air conditioner housing with clean cloth to prevent anything falling in.

- Unscrew bolts on left and right -arrows- for cowl panel grille -1-.

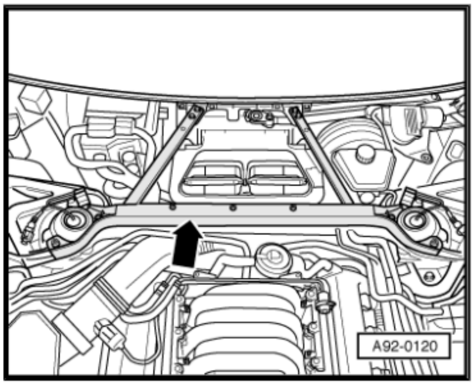


Caution

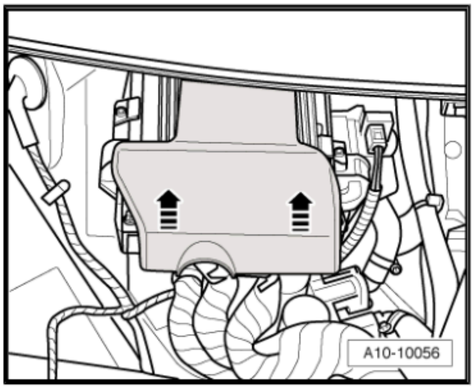
To avoid cracking the cowl panel grille -1- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel grille and pull the grille vertically up out of the fastening strip, starting from the edge of the windscreen.

- Carefully pull cowl panel grille off retainer at windscreen.

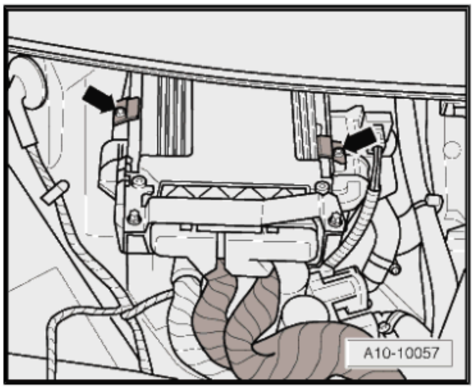
- Unscrew body brace -arrow-.



- Detach cover above engine control unit -arrows-.



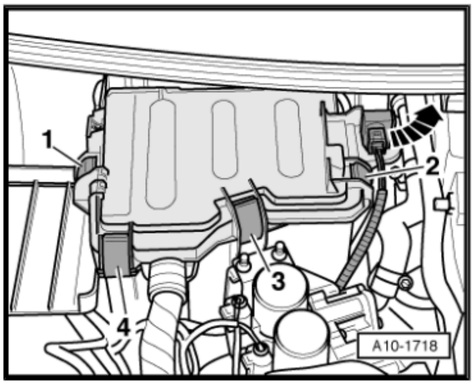
- Remove bolts -arrows-.
- Detach retainers and engine control unit from electronics box (plenum chamber).



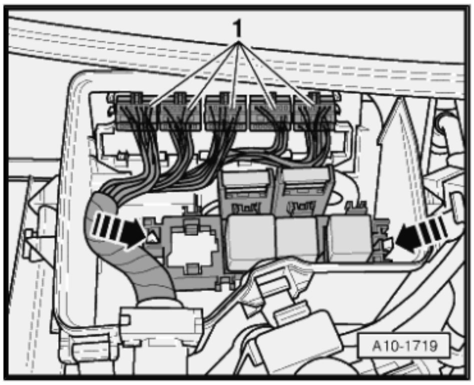
Note

The electrical wires remain connected.

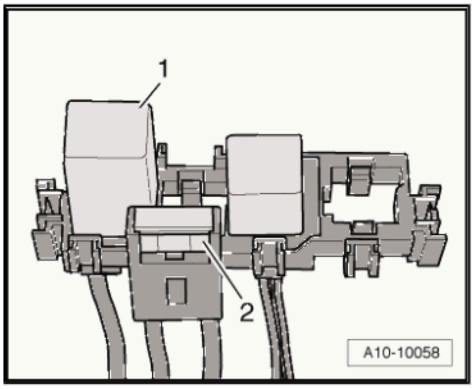
- Turn air quality sensor -G238- approx. 90° anti-clockwise -arrow- and remove from retainer.
- Release retaining clips -1 ... 4-.
- Open electronics box (plenum chamber) cover slightly and pull off to front.



- Disconnect the electrical multi-pin connectors -1- using spark plug connector pliers -V.A.G 1922- .
- Release retainers -arrows- and push auxiliary relay carrier in electronics box upwards to remove.



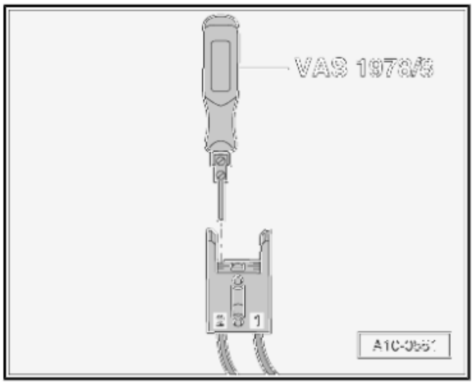
- Disconnect relay -1- and unclip socket from relay carrier.
- Pull out fuse -2-.



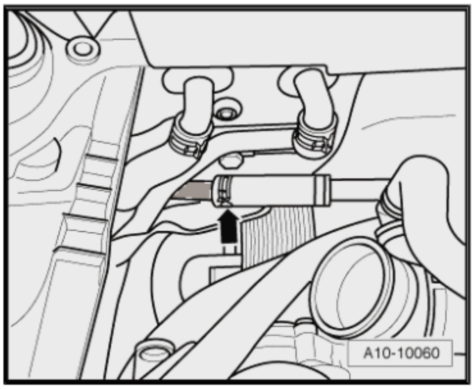
- Release connector contact in chamber -2- of fuse socket using release tool -VAS 1978/8A- .
- Place engine control unit with wiring harness attached on top of engine.

Note

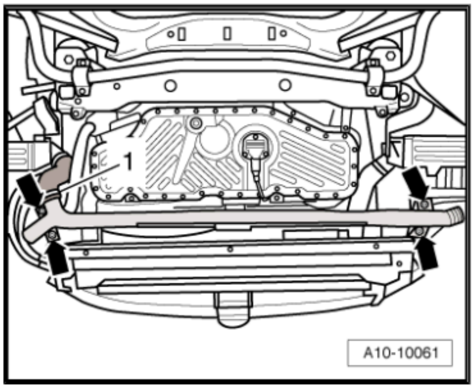
Secure the engine control unit to prevent it falling.



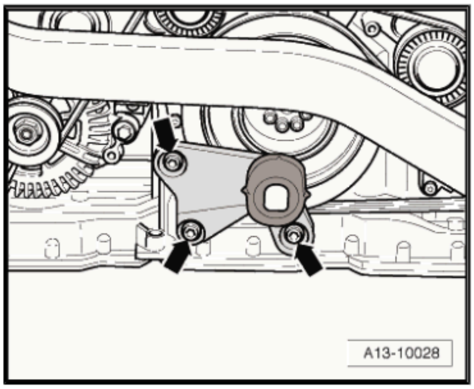
- Disconnect coolant hose -arrow- in front of bulkhead (right-side).



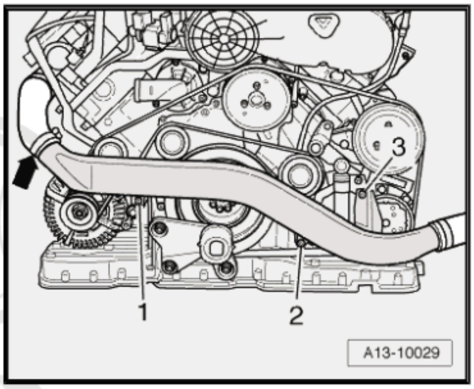
- Disconnect air intake hose -1-.
- Unscrew bolts -arrows- and take out air pipe (bottom).



- Unscrew bolts -arrows- and detach torque reaction support from engine.



- Disconnect air intake hose -arrow-.
- Unscrew bolts -1 ... 3- and detach air pipe (top) from engine.

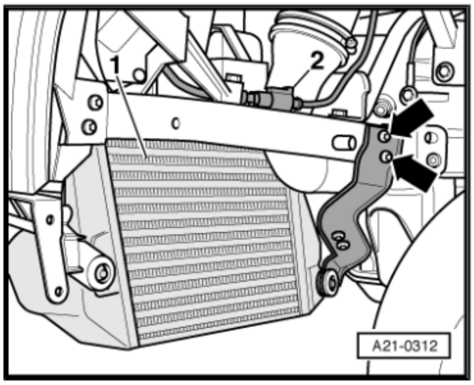


Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Remove poly V-belt.

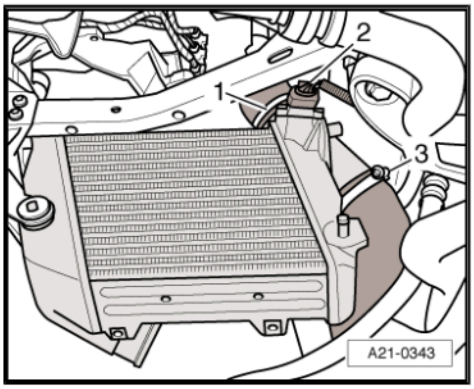
- Remove bolts -arrows- and detach bracket -1- for charge air cooler.



Note

Disregard -item 2-.

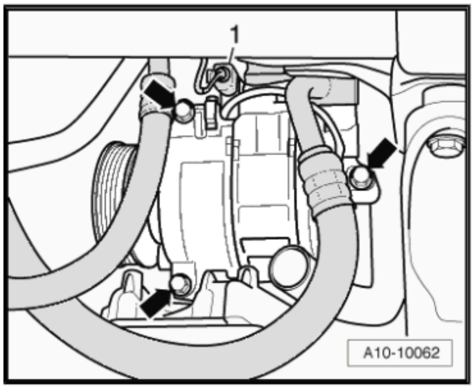
- Unplug electrical connector -2- going to charge pressure sender -G31- .
- Disconnect air intake hose -1-.
- Take off charge air cooler.



Note

Disregard -item 3-.

- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.



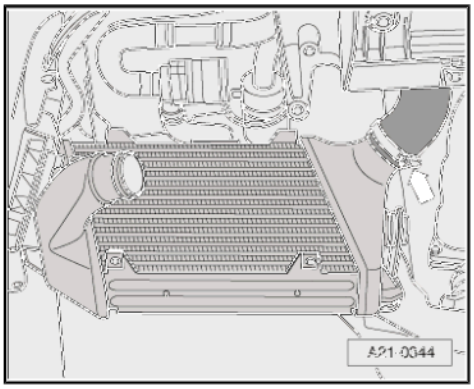
WARNING

The air conditioner refrigerant circuit must not be opened.

Note

To prevent damage to the refrigerant lines, ensure that the pipes and hoses are not stretched, kinked or bent.

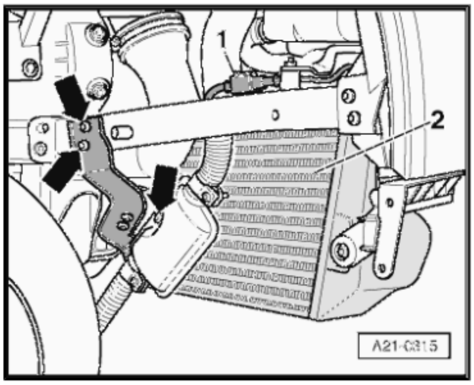
- Unscrew air conditioner compressor from bracket -arrows-.
- Tie up air conditioner compressor with lines attached to left-side of vehicle.
- Disconnect air hose -arrow- at front of charge air cooler (right-side).



- Remove bolts -arrows- and detach bracket for charge air cooler.
- Take off charge air cooler -2- (right-side).

Note

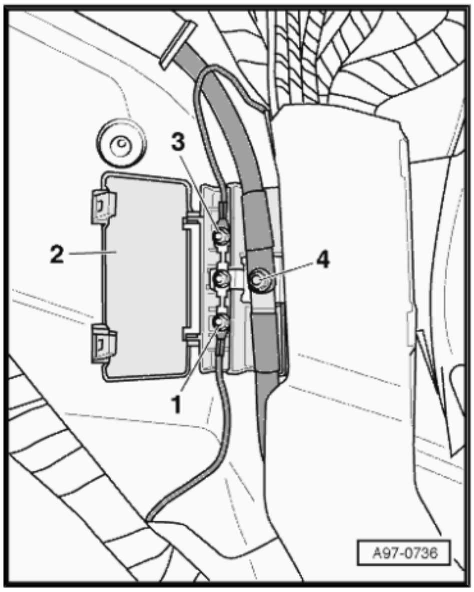
Disregard -item 1-.



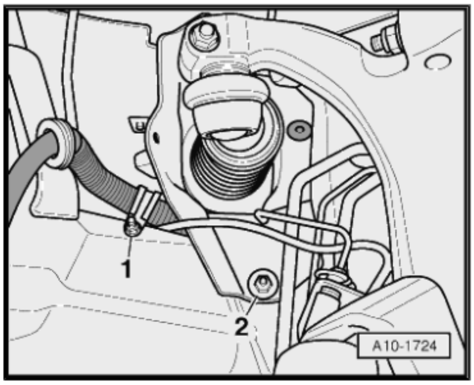
- Remove A-pillar trim (right-side) ⇒ Rep. gr. 70 .
- Fold back floor carpet.
- Detach retaining bracket above main fuse box.
- Fold cover -2- to side.
- Remove nut -4-.
- Detach terminal 30 wire to starter.

Note

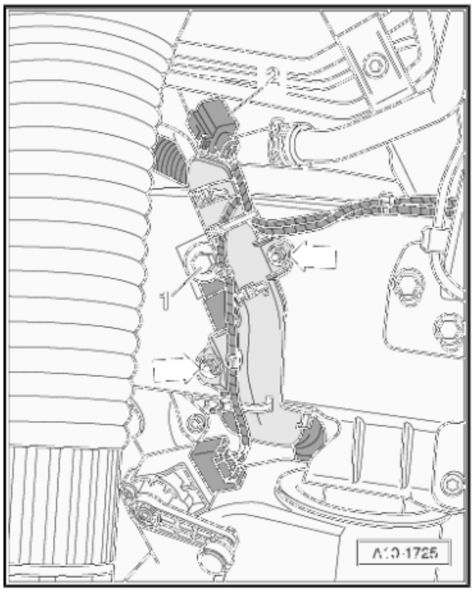
Disregard items -1- and -3-.



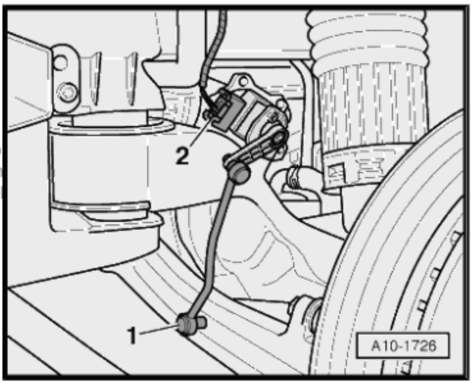
- Remove rear section of wheel housing liner (front right) ⇒ Rep. gr. 66 .
- Unscrew clamp -1-.
- Unscrew retaining nut -2- for track rod cover.



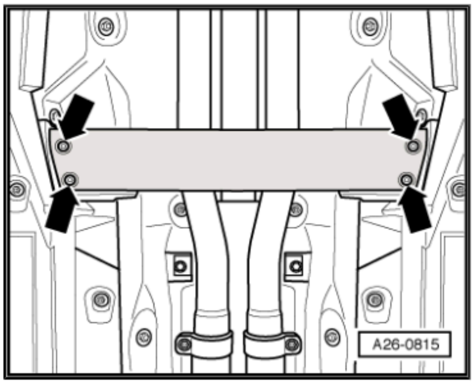
- Unplug electrical connector -2-.
- Unbolt earth cable -1- at longitudinal member.
- Unbolt bracket for wiring harness from longitudinal member -arrows-.
- Move wiring harness clear.



- Unplug electrical connector -2- at vehicle level sender.
- Detach coupling rod -1- at track control link.
- Repeat procedure on other side of vehicle.



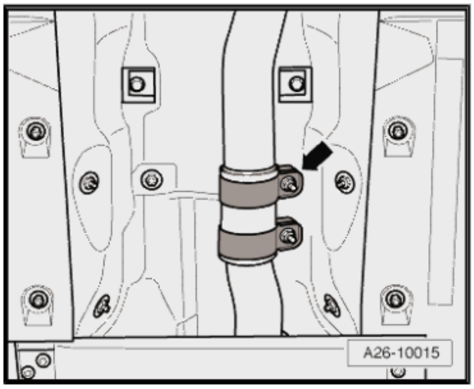
- Remove front cross member -arrows-.



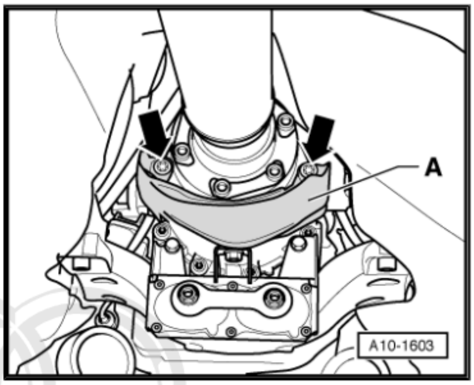
Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

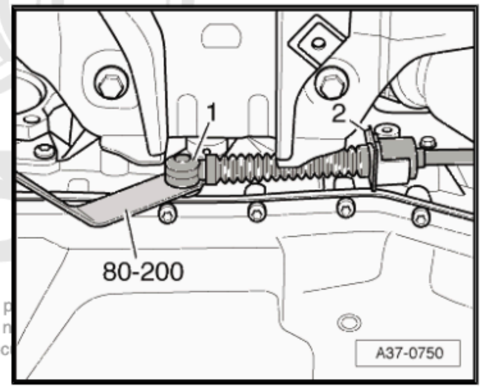
- Disconnect exhaust system at clamp -arrow- and tie up front exhaust pipe on gearbox.



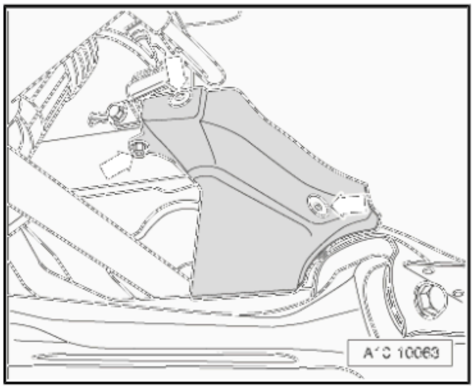
- Unbolt heat shield for propshaft -A - -arrows-.
- Unscrew bolts at gearbox/propshaft flange.
- Push propshaft back towards rear final drive. The constant velocity joints can be moved axially.
- Tie up propshaft on body.



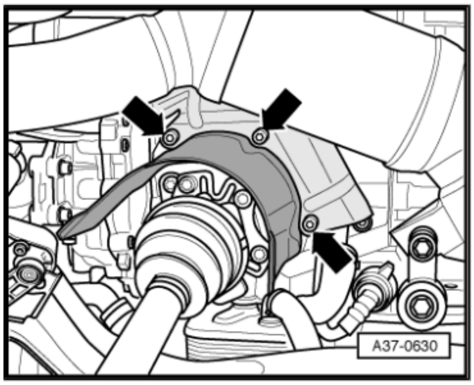
- Pry ball socket -1- of selector lever cable off selector shaft lever using removal lever -80 - 200- .
- Unclip retaining clip -2- at support bracket for selector lever cable.
- Move selector lever cable clear.



- Remove noise insulation in left-side wheel housing -arrows-.

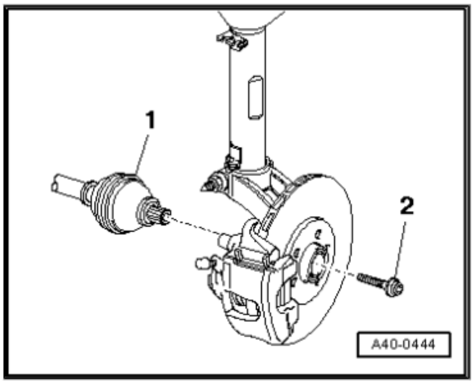


- Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.
- Unbolt drive shafts (left and right) from gearbox flanges.

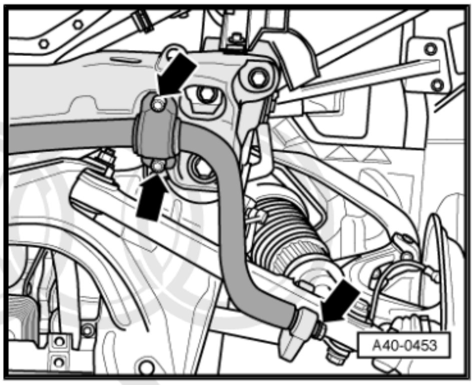


- Have a 2nd mechanic press the brake pedal.

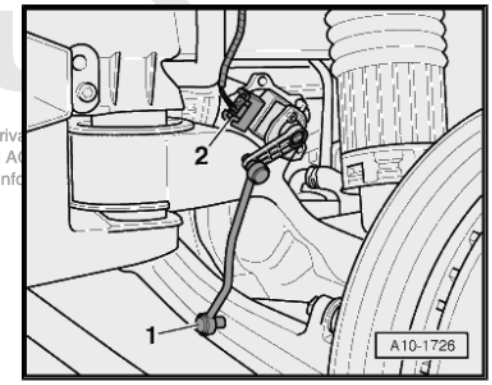
> Caution
>
> *When slackening the flange bolt securing the drive shaft, the wheel bearing must not be under load (vehicle must not be standing on its wheels).*



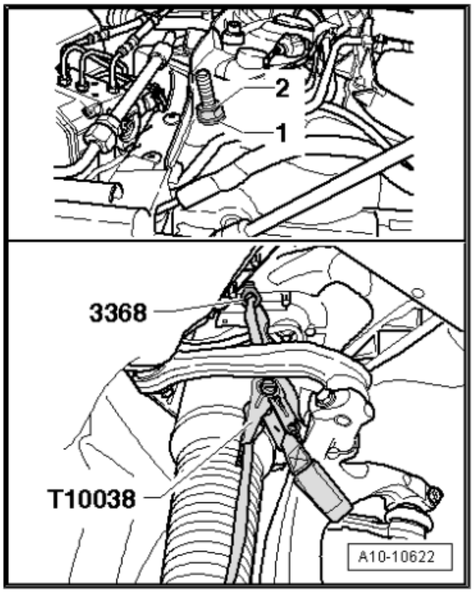
- Unscrew flange bolt -2- from drive shaft -1- (left and right).
- Take out drive shafts (left and right).



- Unscrew bolts (left and right) -arrows- evenly.
- Take out anti-roll bar.



- Unplug electrical connector -2- at vehicle level sender.
- Detach coupling rod -1- at track control link.

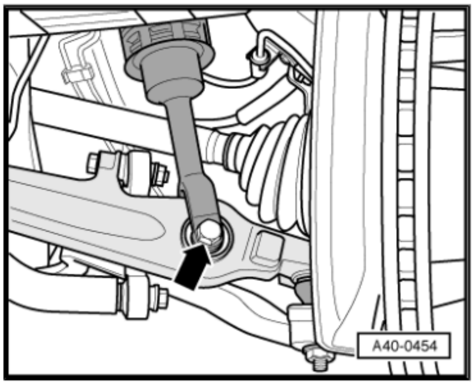


- Fit eye-head bolt -3368- from below in bore on suspension turret on both sides.
- Secure eye-head bolts -3368- with nut -2- and washer -1- (screw down nut several turns but not all the way down).

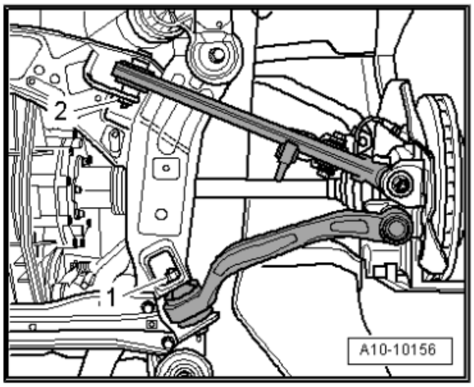
> Caution
>
> *The weight of the wheel bearing housings must be supported in order to prevent damage to the joints of the upper links.*

- Tie up wheel bearing housing on each side using tensioning strap -T10038- as illustrated.

- Unbolt air spring strut (left-side) from track control link -arrow-.



- Unbolt guide link -1- and track control link -2- at subframe.

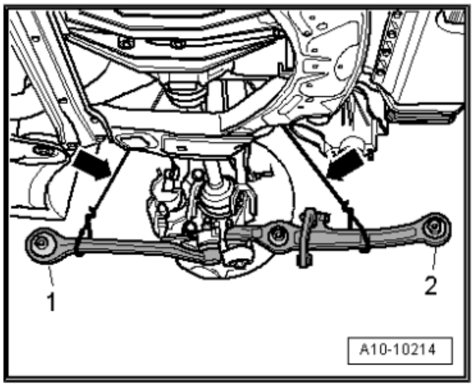


- Pivot guide link -1- and track control link -2- outwards.

Caution

The guide link and track control link must not be allowed to hang down without support. Tie up both bottom links to wheel bearing housing as illustrated -arrow-.

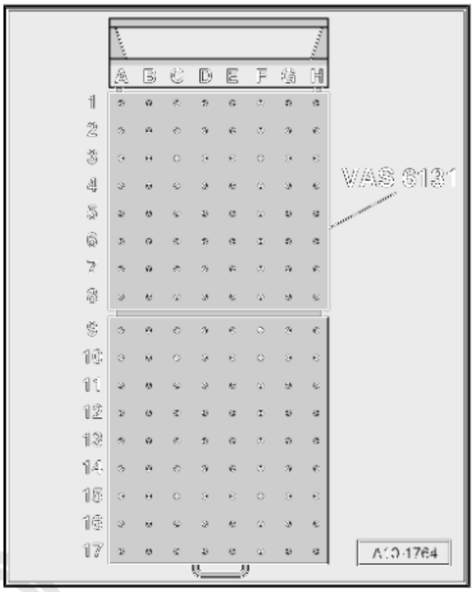
- Repeat procedure on other side of vehicle.



Set up the scissor-type assembly platform as follows:

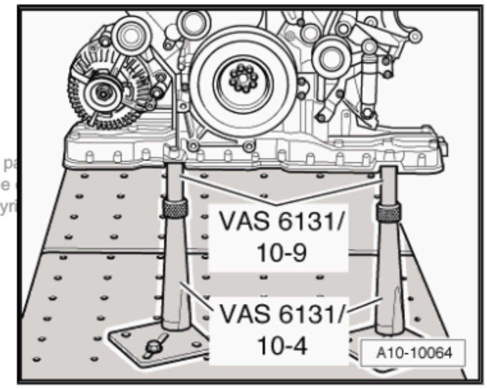
- Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- as follows:

Platform coordinates	Parts from support set for Audi -VAS 6131/10-			
B3	/10-1	/10-4	/10-5	/10-9
F3	/10-1	/10-4	/10-5	/10-9
B6	/10-1	/10-2	/10-5	/10-7
G6	/10-1	/10-2	/10-5	/10-7
B10	/10-1	/10-2	/10-5	/10-8
G10	/10-1	/10-2	/10-5	/10-8
D15	/10-1	/10-3	/10-5	/10-12
F13	/10-1	/10-3	/10-5	/10-12

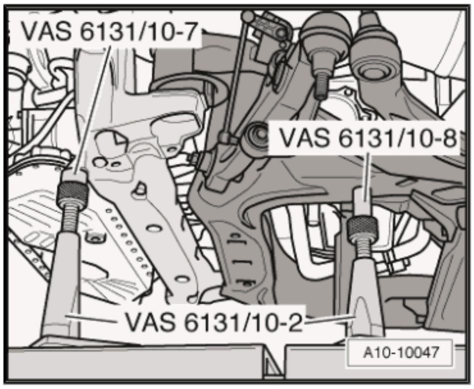


- Initially tighten the support elements on the assembly platform only hand-tight.
- Adjust the scissor-type assembly platform -VAS 6131 A- so that it is horizontal.
- Take note of spirit level (bubble gauge).
- Place scissor-type assembly platform -VAS 6131 A- under engine/gearbox assembly.

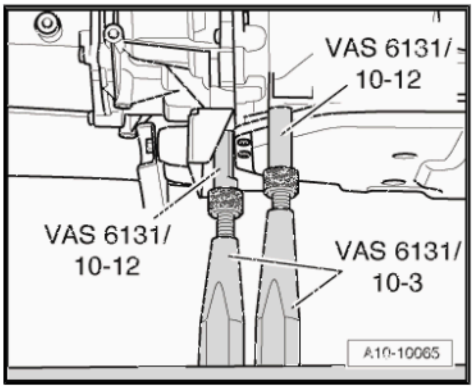
- Position the support elements from -VAS 6131/10- at front of engine, as shown in the illustration.
- Make sure that threaded spindles are screwed in completely.



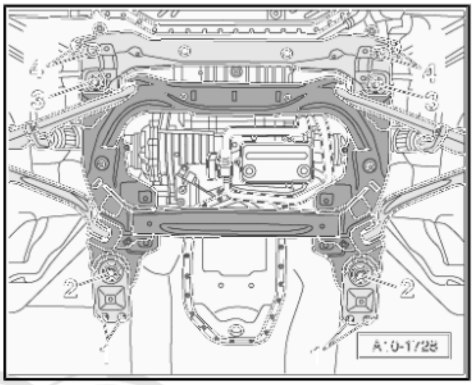
- Position support elements from -VAS 6131/10- on engine cross member and subframe (left and right), as shown in the illustration.



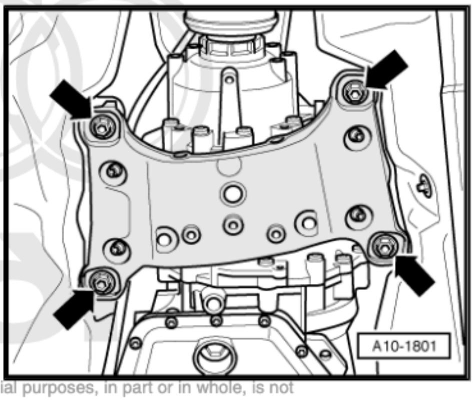
- Position support elements from -VAS 6131/10- at rear of gearbox, as shown in the illustration.
- Turn all spindles for the support elements upwards until all locating lugs make contact with the mounting points.
- Tighten base plates for support elements on scissor-type assembly platform -VAS 6131 A- to 20 Nm.



- Mark the installation position of the subframe and engine cross member on longitudinal members with felt-tip pen.
- Remove bolts -1- and -4-.
- Remove bolts -2- and -3- in a diagonal sequence and in stages.



- Remove bolts -arrows- at tunnel cross member.



Note

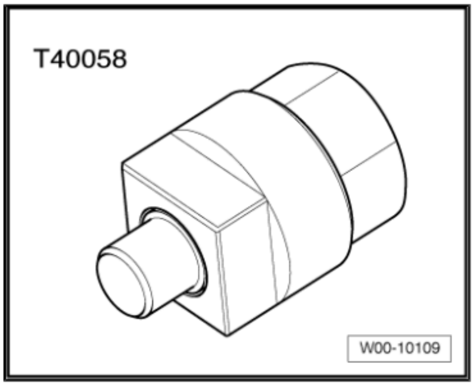
- *Check that all hoses and wiring connections between engine, gearbox, subframe and body have been detached.*
- *Carefully guide out engine/gearbox assembly with subframe from engine compartment when lowering to avoid damage.*

- Lower engine/gearbox assembly gradually.
- Pull out scissor-type assembly platform -VAS 6131 A- from under the vehicle.

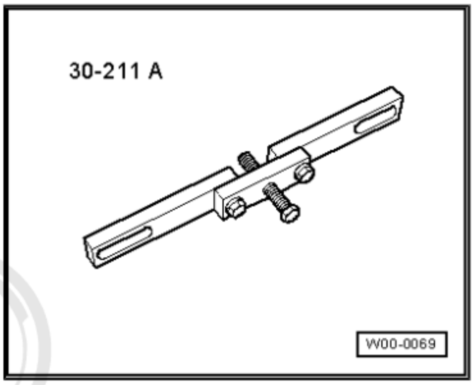
1.2 Separating engine and gearbox

Special tools and workshop equipment required

- Adapter -VAS 6131/10-12- and support set, Audi A8 >2002 - VAS 6131/11-
- Adapter -T40058-

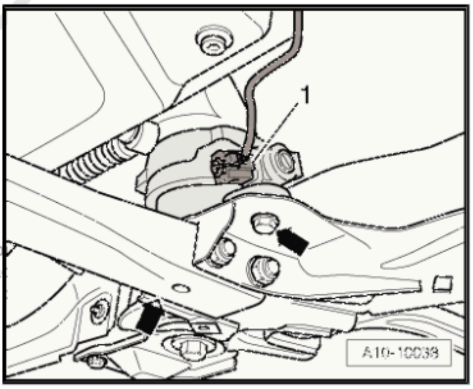


- ◆ Support bridge -30 - 211 A-

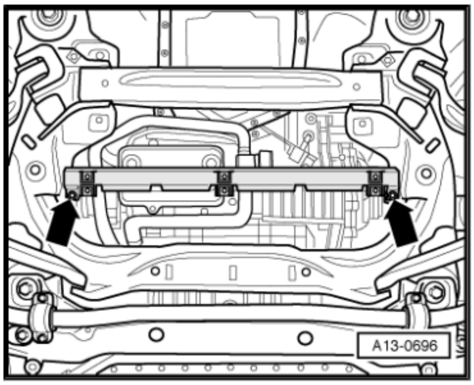


Procedure

- • Engine/gearbox assembly removed and in position on scissor-type assembly platform -VAS 6131 A- .
- – Unplug electrical connector -1- at gearbox mounting (left-side).
- – Remove bolts -arrows- for gearbox mountings.
- – Repeat procedure on opposite side of vehicle.



- – Unbolt bracket for noise insulation -arrows-.

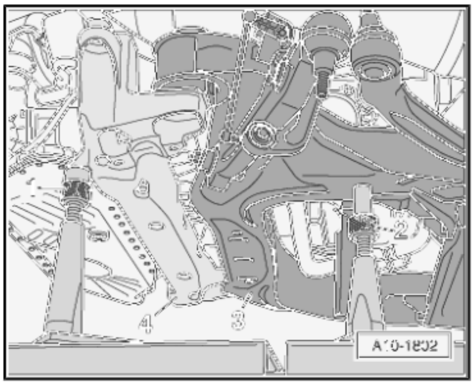


- – Screw down spindles of support elements -2- (left and right) at subframe as far as possible.
- – Remove locating lugs from spindles.
- – Take out subframe -3- from the side.

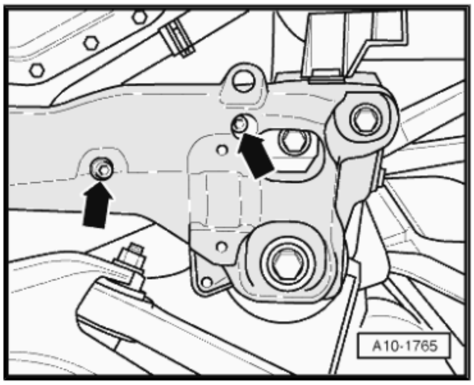
Note

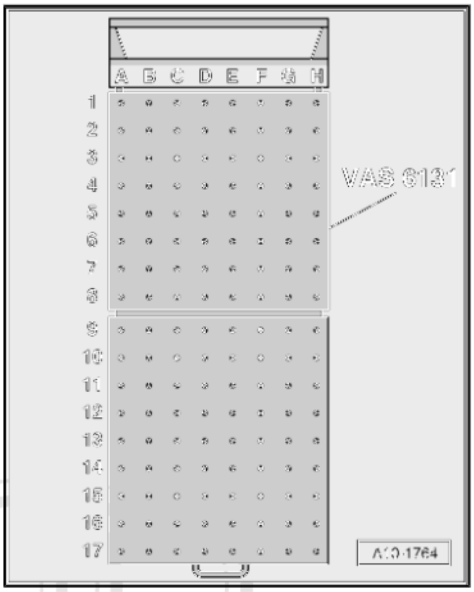
A second mechanic is required for removing the subframe.

- – Screw down spindles of support elements -1- (left and right) at engine cross member -4- as far as possible.



- Remove bolts -arrows- for engine mounting (left and right-side)
- Take out engine cross member.
- Unscrew the 4 base plates for support elements (for engine cross member and subframe) at assembly platform -VAS 6131 A- .





Note

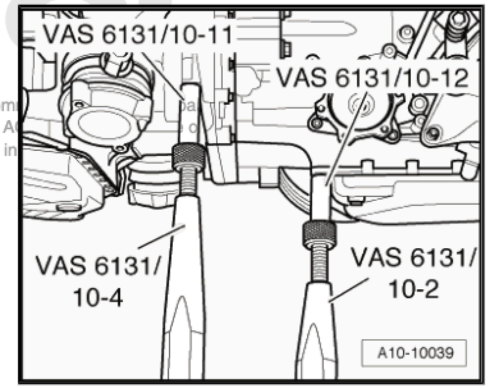
The mounting points for engine (front) and gearbox (rear) remain unchanged.

- Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- and support set, Audi A8 >2002 -VAS 6131/11- as follows:

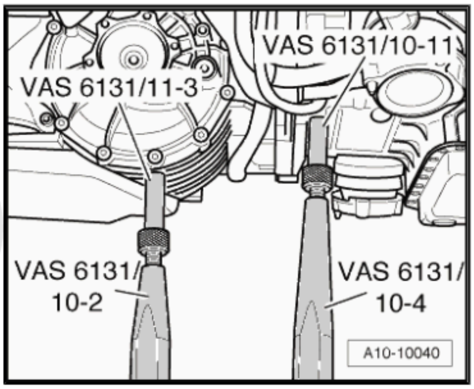
Platform coordinates	Parts of support set for Audi -VAS 6131/10- and support set, Audi A8 >2002 -VAS 6131/11-			
B3 1)	/10-1	/10-4	/10-5	/10-9
F3 1)	/10-1	/10-4	/10-5	/10-9
B7	/10-1	/10-4	/10-5	/10-11
F7	/10-1	/10-4	/10-5	/10-11
B10	/10-1	/10-2	/10-5	/10-12
G10	/10-1	/10-2	/10-5	/11-3
D15 1)	/10-1	/10-3	/10-5	/10-12
F13 1)	/10-1	/10-3	/10-5	/10-12

- 1) Support elements remain unchanged.

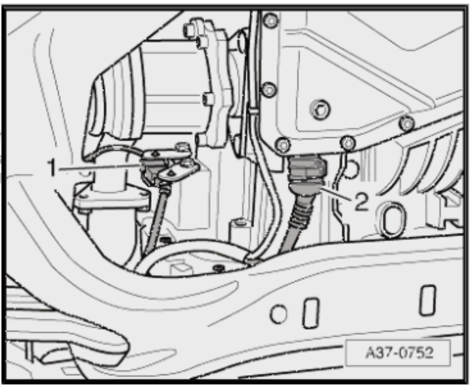
- Position support elements from -VAS 6131/10- at left of engine/gearbox assembly, as shown in illustration.



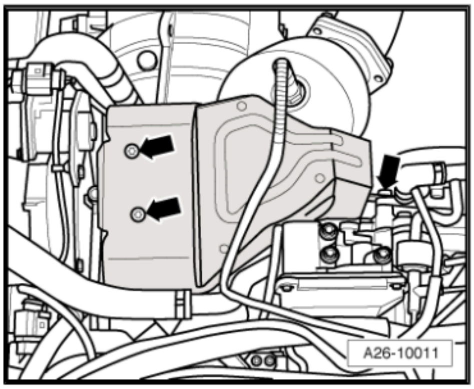
- Place support elements from -VAS 6131/10- and -VAS 6131/11- at right of engine/gearbox assembly, as shown in illustration.
- Turn spindles for the support elements upwards until all locating lugs make contact with the mounting points.
- Tighten base plates for support elements on scissor-type assembly platform -VAS 6131 A- to 20 Nm.



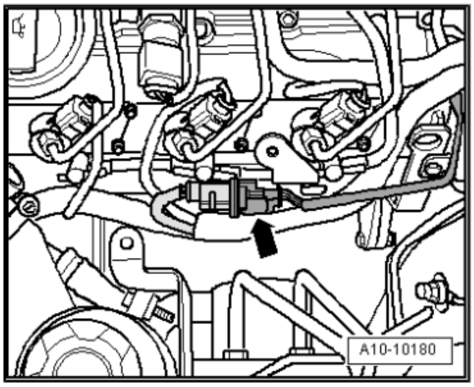
- Unplug electrical connector -1- for engine speed sender -G28- .
- Turn retainer catch anti-clockwise and unplug electrical connector -2- at gearbox.



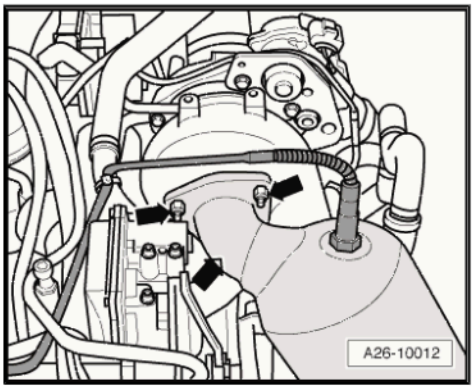
- Remove heat shield for turbocharger -arrows-.



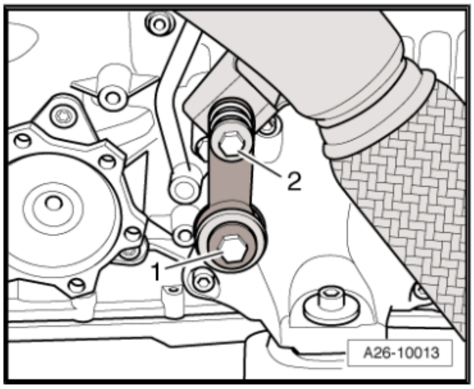
- Unplug electrical connector -arrow- for Lambda probe -G39- and move wiring clear.



– Unscrew nuts -arrows- at starter catalytic converter/turbocharger.



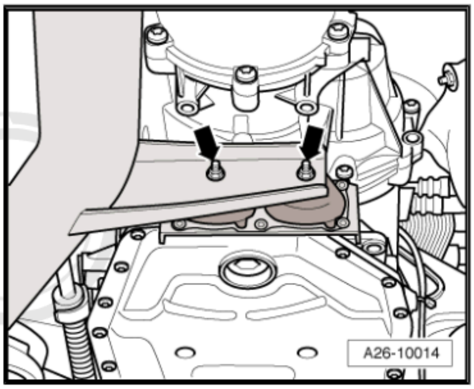
– Remove bolt -2- on bracket for front exhaust pipe.



Note

Disregard -item 1-.

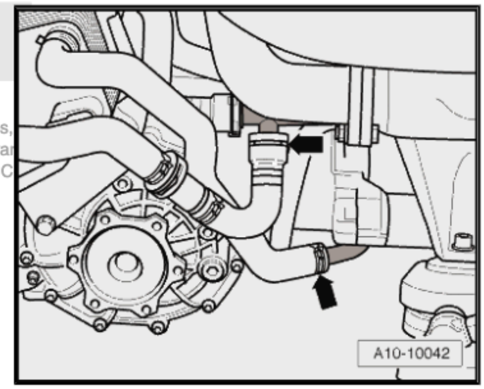
– Unscrew nuts -arrows- and detach catalytic converter with front exhaust pipe.



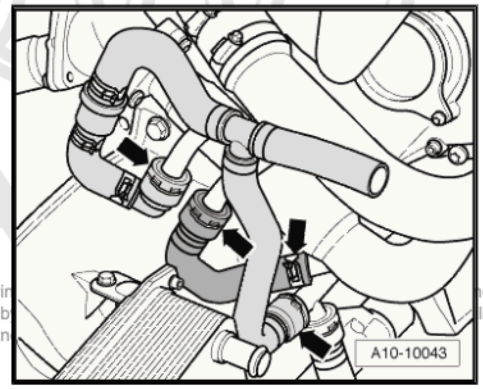
Note

Lay a cloth under the connection to catch escaping coolant.

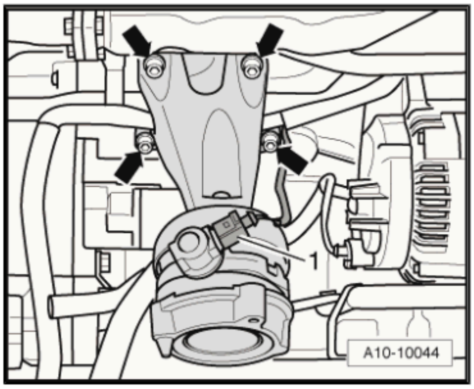
– Disconnect coolant hoses going to ATF cooler at the connections indicated -arrows-.



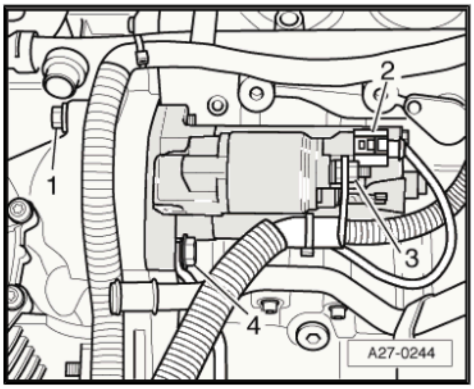
- Detach coolant hoses at the connections indicated -arrows-.
- Remove coolant hoses.



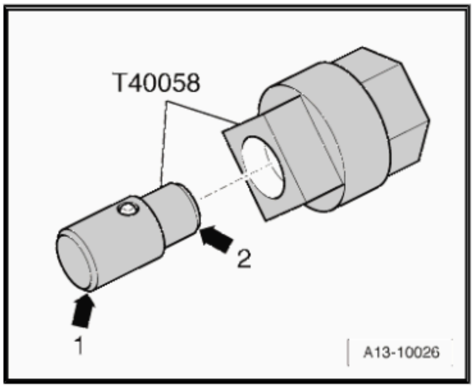
- Unplug electrical connector -1- at engine mounting (right-side).
- Unscrew bolts -arrows- and remove engine support (right-side).



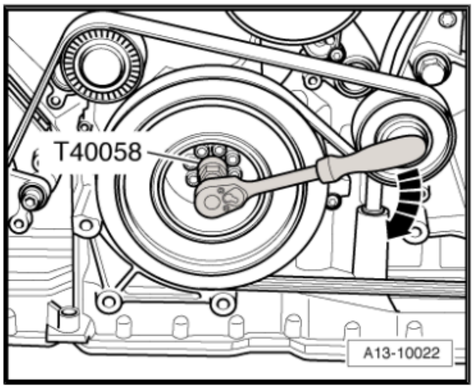
- Detach electrical wires -2- and -3- at starter.
- Remove bolts -1- and -4- and detach starter.



- Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.



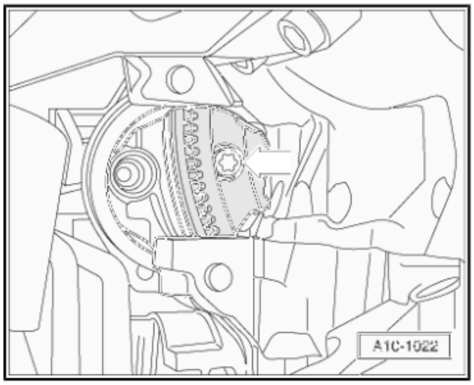
- When loosening torque converter bolts, counterhold crankshaft using adapter -T40058- .



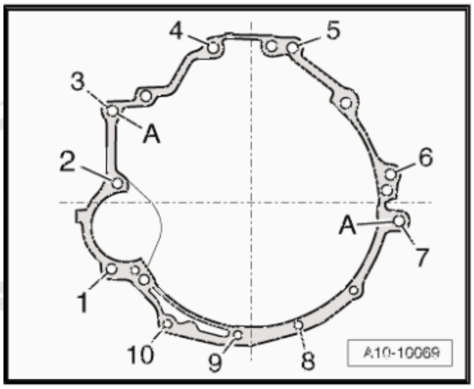
Note

Disregard -arrow-.

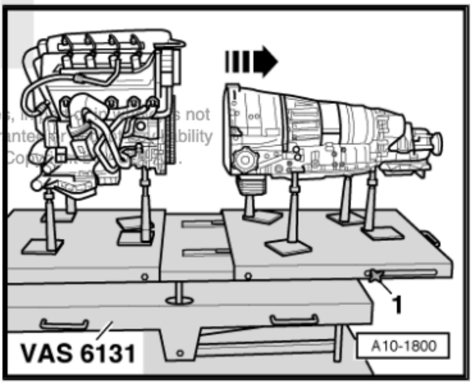
- Unscrew 3 Torx socket head bolts -arrow- on torque converter through opening of removed starter (turn crankshaft $^1/_3$ turn each time).



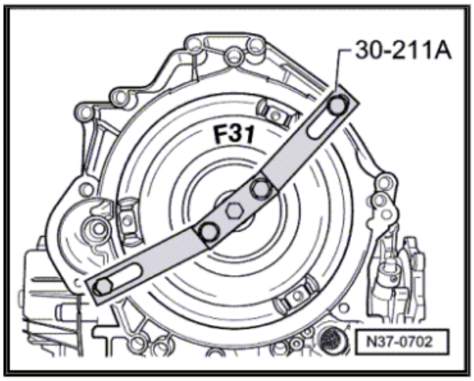
- Remove engine/gearbox securing bolts -3 ... 10-.



- Loosen clamping bolts -1- on sides of scissor-type assembly platform -VAS 6131 A- and pull rear section of platform together with gearbox towards the rear -arrow-; simultaneously separate the torque converter from the drive plate through the opening.



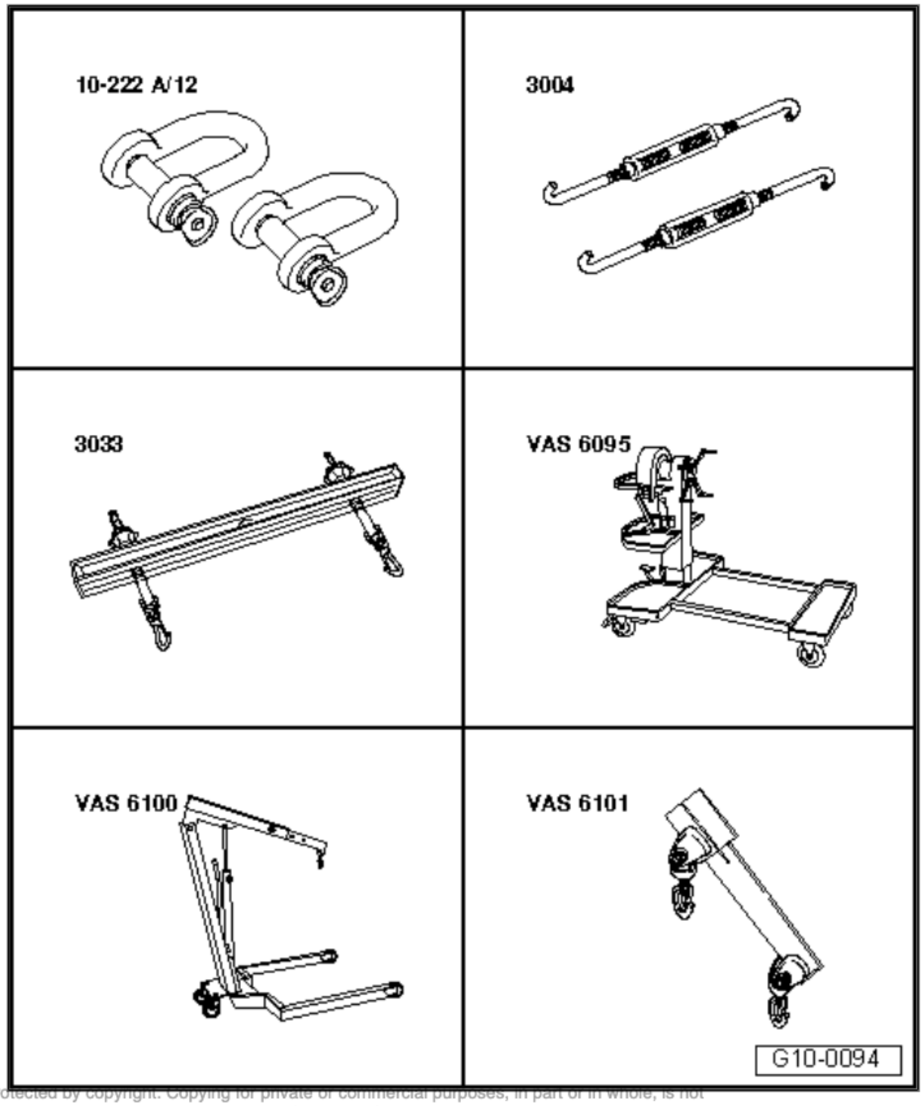
– Secure the torque converter in the gearbox using support bridge -30 - 211 A- to prevent it falling out.



1.3 Securing engine to engine and gearbox support

Special tools and workshop equipment required

- Shackle -10 - 222 A /12-
- Hook -3004-
- Lifting tackle -3033-
- Engine and gearbox support -VAS 6095- with support bracket for V6 TDI engine, Audi A8 -VAS 6095/1-4-
- Workshop hoist - VAS 6100-
- Lift arm extension (workshop hoist) -VAS 6101-



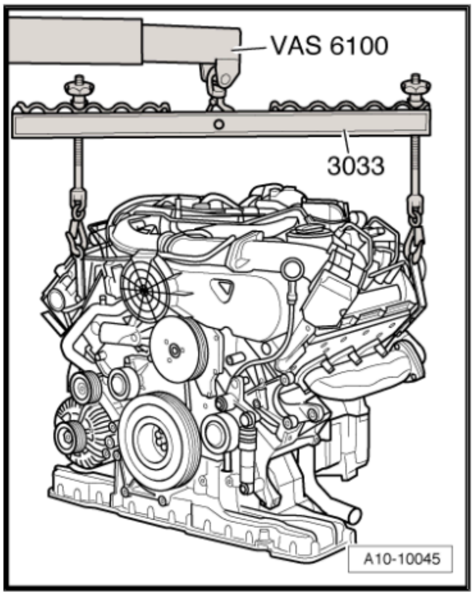
Procedure

- Engine separated from gearbox ⇒ page 27 .

Note

For better accessibility with workshop hoist -VAS 6100- it is advisable to remove the sliding bar from scissor-type assembly platform -VAS 6131 A- .

– Attach lifting tackle -3033- to workshop hoist -VAS 6100- as shown in the illustration.



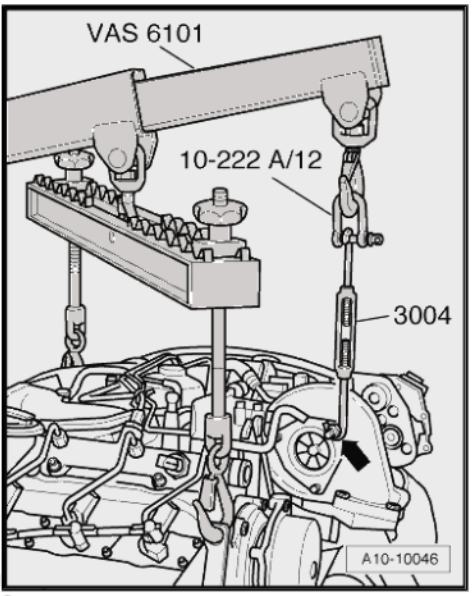
– Screw a nut -arrow- about 4 turns onto stud on turbocharger.

– Attach lift arm extension -VAS 6101- to workshop hoist -VAS 6100- .

– Connect lift arm extension -VAS 6101- to shackle -10 - 222 A / 12- and engage hook -3004- on stud.

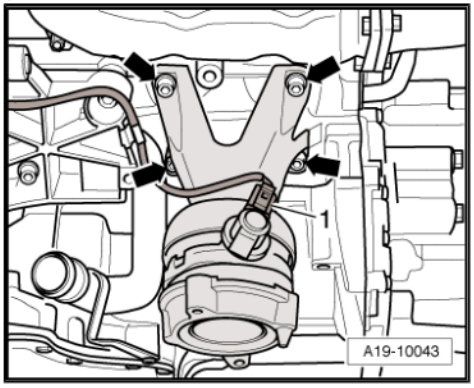
– Tension hook -3004- so that engine is taken up horizontally.

– Lift engine off the support elements on scissor-type assembly platform -VAS 6131 A- .

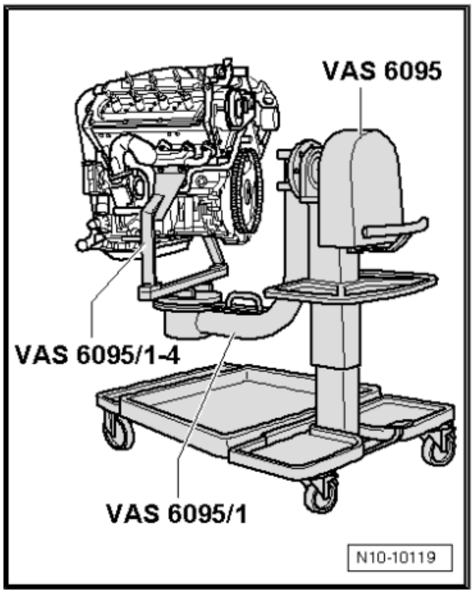


– Unplug electrical connector -1- at engine mounting (left-side).

– Remove bolts -arrows- and detach engine support (left-side).



– Using support bracket for V6 TDI engine, Audi A8 -VAS 6095/1-4- , secure engine to engine and gearbox support - VAS 6095- as shown in the illustration. Tightening torque: 42 Nm.

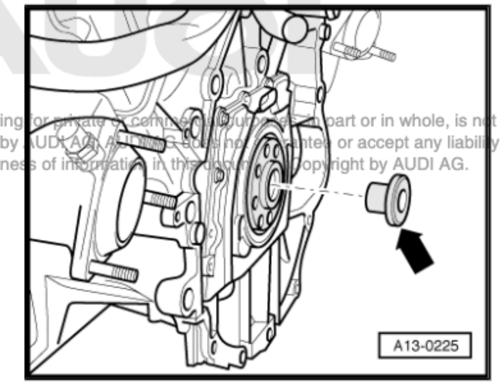


1.4 Installing engine

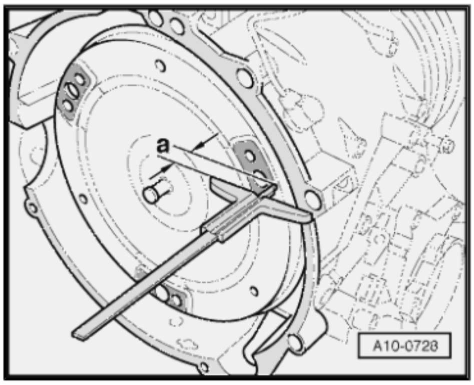
Note

- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Reinstall all cable ties in the same locations when assembling.*

– Before installing an exchange engine in a vehicle with automatic gearbox, check whether the centralising bush -arrow- for the torque converter is fitted at the rear of the crankshaft.



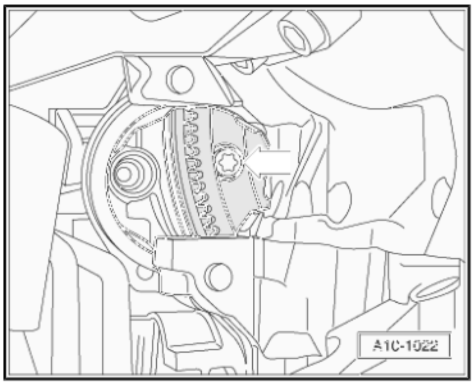
Checking installation depth of torque converter



If the torque converter has been correctly installed, the distance -a- between the contact surfaces at the threaded holes in the torque converter and the joint surface on the torque converter bell-housing for automatic gearbox 09L is at least 19 mm.

Caution

If the torque converter is not installed correctly, the drive lugs of the torque converter and the ATF pump will be seriously damaged when the gearbox is joined to the engine.



– Before bringing engine and gearbox together, turn torque converter and drive plate on engine so that the holes for one securing bolt are in line with the opening for the starter motor -arrow-.

– To secure torque converter on drive plate, use only new ribbed bolts of the correct type (same as original equipment) as specified in ⇒ Parts catalogue .

– Bolt gearbox to engine.

Caution

Before and during tightening of bolts on engine/gearbox flange, continually check that the torque converter behind the drive plate can be turned. If the converter cannot be turned, it must be assumed that it has not been installed correctly and the drive lugs of the ATF pump and consequently the gearbox will be damaged when the bolts are finally tightened.

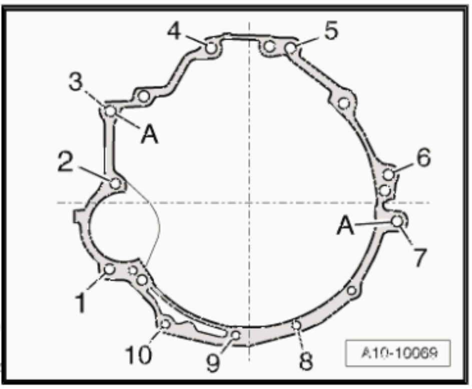
Note

- ♦ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ♦ *Additional lubricant such as engine oil or gearbox oil may be used, but do not use lubricant containing graphite.*
- ♦ *Do not use degreased parts.*
- ♦ *Tolerance for tightening torques: ± 15%.*

Securing engine to gearbox

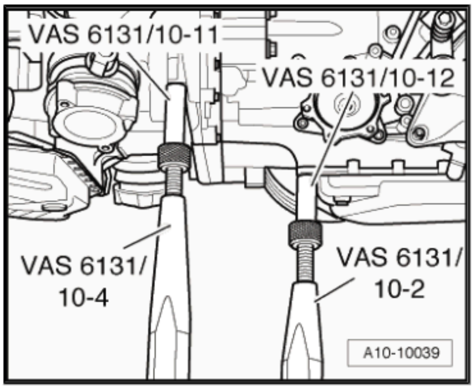
Item	Bolt	Nm
1	M10x80	65 1)
2	M10x90	65 1)
3 … 5	M12x95	65
6, 7	M12x115	65
8, 9, 10	M10x80	45
A	Dowel sleeves for centralising	

- 1) Property class 10.9.

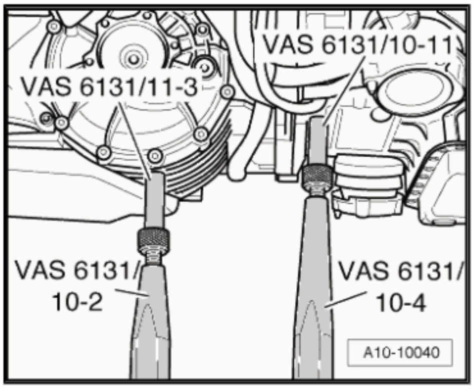


Installation is carried out in the reverse order; note the following:

- Install starter catalytic converter: vehicles without particulate filter ⇒ page 263 , vehicles with particulate filter ⇒ page 272 .
- Install front exhaust pipe with main catalytic converter ⇒ page 266 or install particulate filter with main catalytic converter ⇒ page 278 .
- Prior to assembly, always use a thread tap to remove remaining locking fluid from the tapped holes in the flange shaft for the propshaft on the gearbox.



- Screw down spindles of support elements -VAS 6131/10-11- and -VAS 6131/10-12- on left side of engine/gearbox assembly.
- Unscrew both base plates for support elements (left-side) at scissor-type assembly platform -VAS 6131 A- .



- Screw down spindles of support elements -VAS 6131/11-3- and -VAS 6131/10-13- on right side of engine/gearbox assembly.
- Unscrew both base plates for support elements (right-side) at scissor-type assembly platform -VAS 6131 A- .

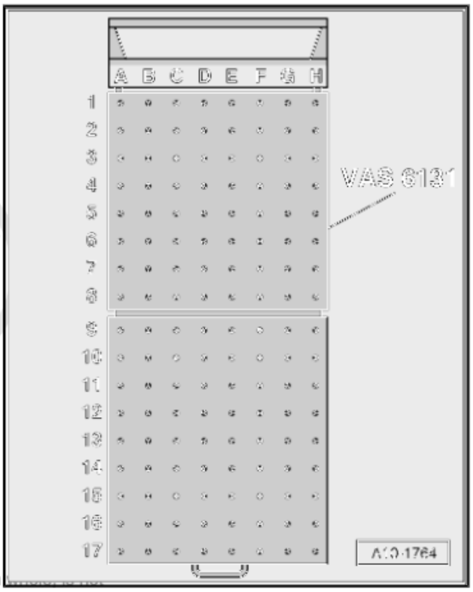
Note

The mounting points for engine (front) and gearbox (rear) remain unchanged.

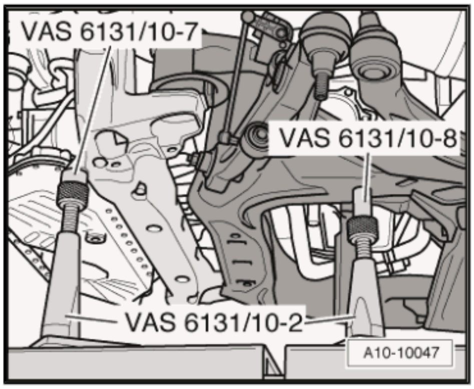
- Set up scissor-type assembly platform -VAS 6131 A- with support set for Audi -VAS 6131/10- as follows:

Platform coordinates	Parts from support set for Audi -VAS 6131/10-			
B3 1)	/10-1	/10-4	/10-5	/10-9
F3 1)	/10-1	/10-4	/10-5	/10-9
B6	/10-1	/10-2	/10-5	/10-7
G6	/10-1	/10-2	/10-5	/10-7
B10	/10-1	/10-2	/10-5	/10-8 2)
G10	/10-1	/10-2	/10-5	/10-8 2)
D15 1)	/10-1	/10-3	/10-5	/10-12
F13 1)	/10-1	/10-3	/10-5	/10-12

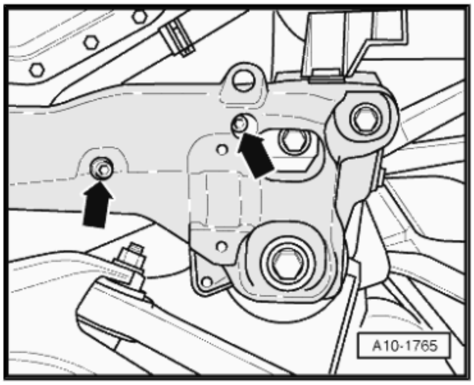
- 1) Support elements remain unchanged.
- 2) Secure support elements only after installing the subframe.



- Position engine cross member on the two support elements -VAS 6131/10-7- .
- Screw up spindles for support elements -VAS 6131/10-7- on both sides.
- Tighten base plates for support elements on scissor-type assembly platform -VAS 6131 A- to 20 Nm.



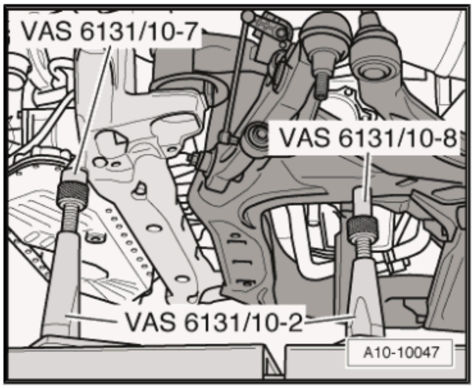
- Tighten bolts -arrows- for engine mountings on both sides.



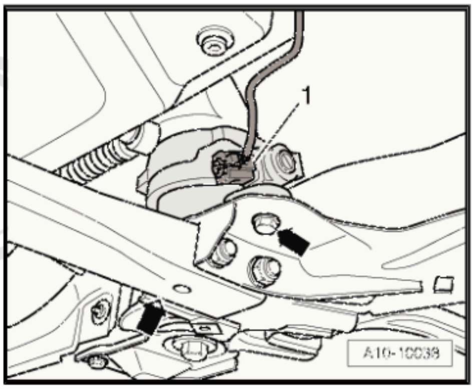
Note

A second mechanic is required for positioning the subframe on the support elements.

- Fit subframe onto the two support elements -VAS 6131/10-8- .
- Screw up spindles for support elements -VAS 6131/10-8- on both sides.
- Tighten base plates for support elements on scissor-type assembly platform -VAS 6131 A- to 20 Nm.



- Tighten bolts for gearbox mountings -arrows- on both sides.
- Reconnect electrical connector -1-.
- Guide engine/gearbox assembly together with subframe and engine cross member into the body from below using scissor-type assembly platform -VAS 6131 A- .
- Adjust the subframe and engine cross member according to the markings previously made on the longitudinal members.



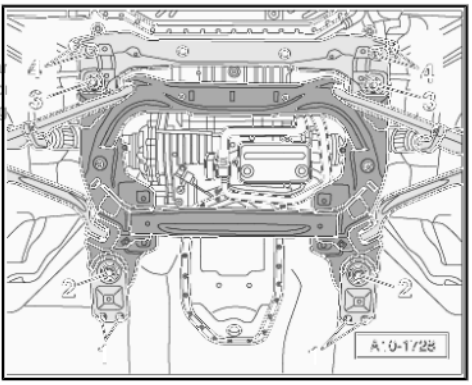
- Tighten subframe bolts only to specified torque (do not turn further); the bolts are only fully tightened after performing the wheel alignment check.

1 - 50 Nm

2 - 150 Nm

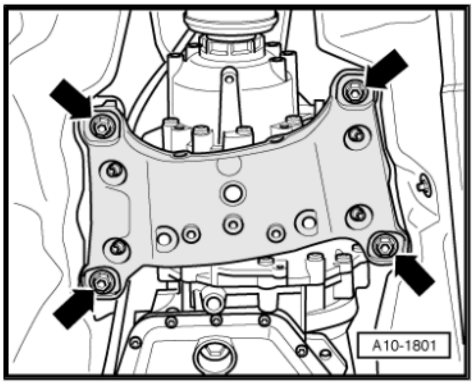
3 - 150 Nm

> WARNING
>
> *The vehicle must not be driven at this stage.*



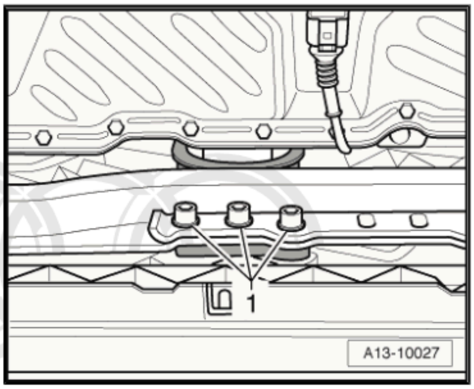
- Tighten bolts -4- for engine cross member.

- Tighten bolts -arrows- at tunnel cross member.



- Install propshaft ⇒ Rear final drive 01R and 0AR; Rep. gr. 39 .
- Install selector lever cable and check adjustment if necessary ⇒ Rep. gr. 37 .
- Align exhaust system so it is free of stress ⇒ page 282 .
- Install guide link, track control link and anti-roll bar ⇒ Rep. gr. 40 .
- Install drive shafts ⇒ Rep. gr. 40 .
- Install charge air cooler ⇒ page 256 .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install power steering pump ⇒ Rep. gr. 48 .
- Install body brace ⇒ Rep. gr. 40 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .

- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedures required after connecting battery ⇒ Rep. gr. 27 .



Caution

Do not use a battery charger to boost starting. There is danger of damaging the vehicle's control units.

- Install and adjust wiper arms ⇒ Rep. gr. 92 .
- Fill cooling system ⇒ page 204 .

Note

- *Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.*
- *Contaminated or dirty coolant must not be used again.*

- Check oil level ⇒ page 200 .
- Perform wheel alignment check ⇒ Rep. gr. 44 .

WARNING

Tighten bolts for subframe to final setting after performing wheel alignment check.

- Check fuel system for leaks ⇒ page 6 .

Tightening torques

Note

- *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- *Additional lubricant such as engine oil or gearbox oil may be used, but do not use lubricant containing graphite.*
- *Do not use degreased parts.*
- *Tolerance for tightening torques: ± 15 %.*

Component		Nm
Bolts/nuts	M6	9
	M8	20
	M10	40
	M12	65
Except for the following:		
Drive plate to torque converter		85 1)
Terminal B+ to starter		16
Engine support to engine		42
Gearbox mounting to subframe		23 1)
Engine cross member to:	Longitudinal member	68
	Engine mounting	23
Bracket for noise insulation to subframe		9
Drive shaft heat shield to gearbox		23
Coolant pipe to gearbox		22
Battery wire to fuse holder		20
Air pipe (top) to engine		9
Torque reaction support to engine		40
Air pipe (bottom) to longitudinal member		40
Intake connecting pipe to:	Intake manifold	9
	Connecting pipe for exhaust gas recirculation	9
Torque reaction support bracket to air pipe (top)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5
• 1) Renew bolts.		

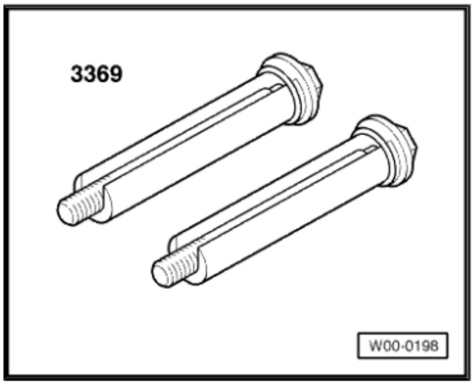
13 – Crankshaft group

1 Servicing work on pulley end

1.1 Moving lock carrier into service position

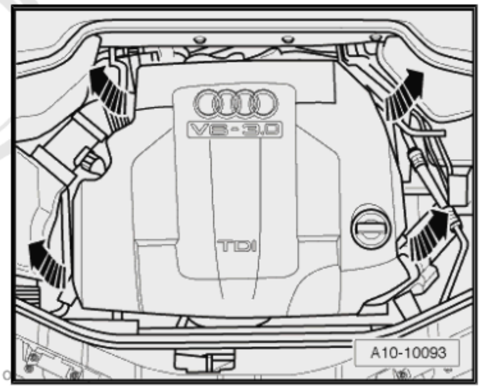
Special tools and workshop equipment required

- Front-end service sleeves -3369-

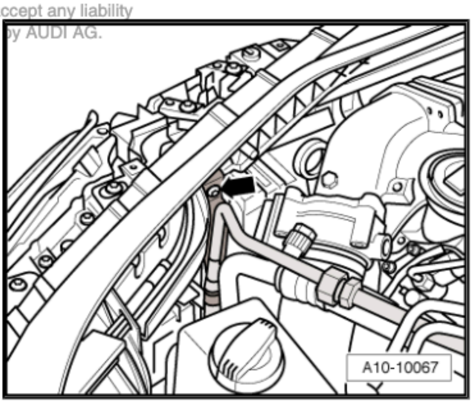


Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Unscrew bracket for air conditioner pipe from lock carrier -arrow-.

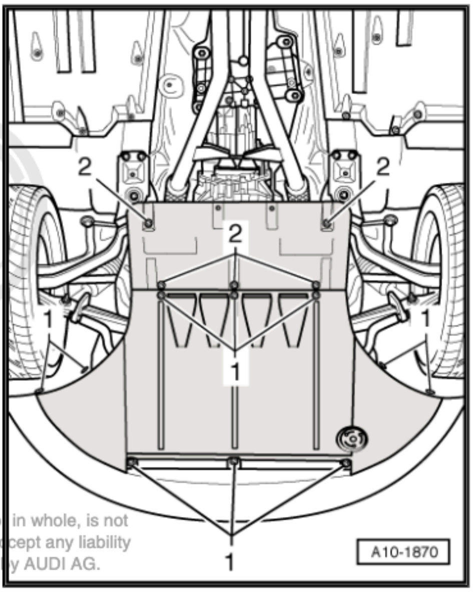


- Remove both front wheels.

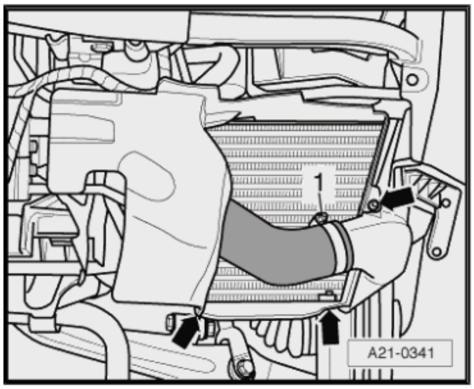
Note

Secure brake discs with wheel bolts.

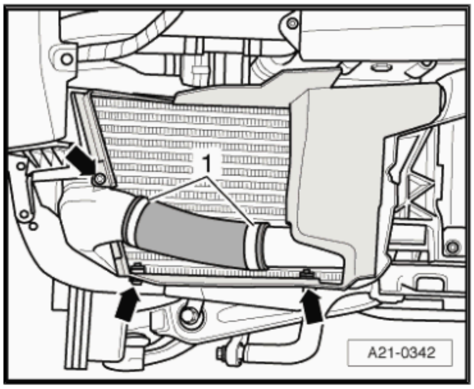
- Open quick-release fasteners -1- and remove noise insulation (front).
- Remove front sections of front wheel housing liners (left and right) ⇒ Rep. gr. 66 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .



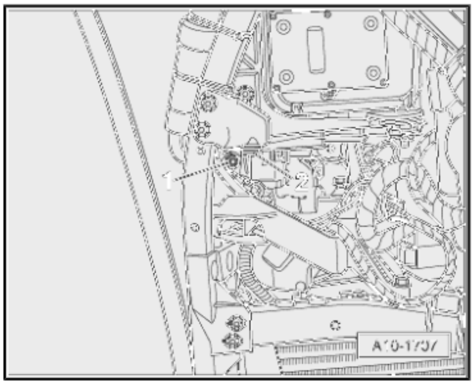
- Open hose clip -1- and disconnect air intake hose.
- Remove bolts -arrows-.
- Detach air duct from charge air cooler (left-side).



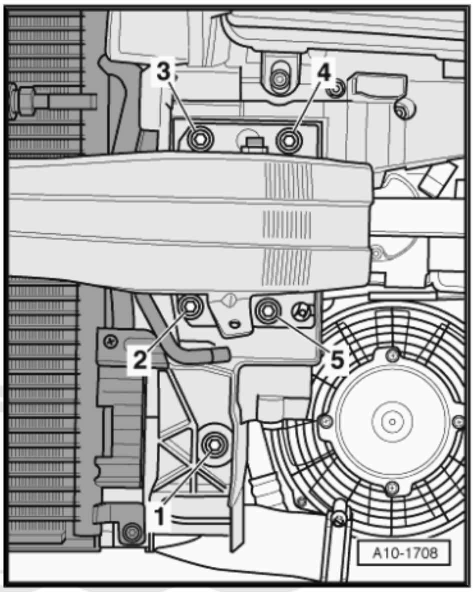
- Open hose clips -1- and disconnect air intake hose.
- Remove bolts -arrows-.
- Detach air duct from charge air cooler (right-side).



- Working from wheel housing, remove one nut -1- and one bolt -2- for lock carrier on each side.

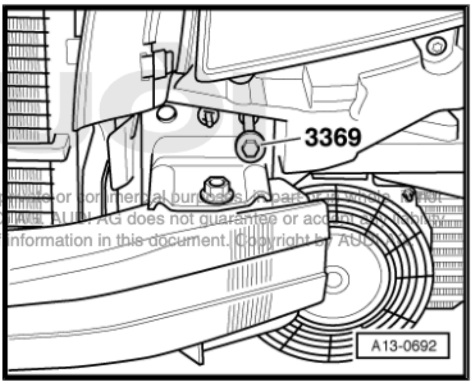


– Unscrew bolts -1 … 5- on both sides of vehicle.



– Remove bolts from front-end service sleeves -3369- (special tool).

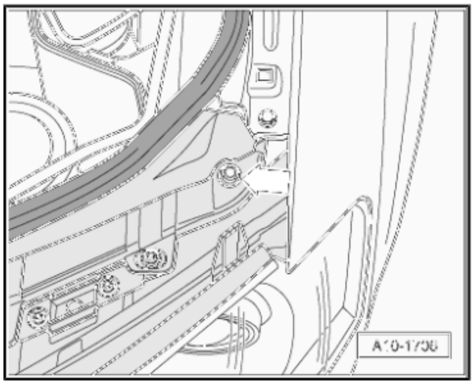
– Screw bolts from front-end service sleeves -3369- into top bolt holes for impact damper (left and right sides).



– Pull off bonnet seal at both wing panels.

– Remove one bolt -arrow- on each side from top of lock carrier.

– Carefully pull the lock carrier forward.



Installing

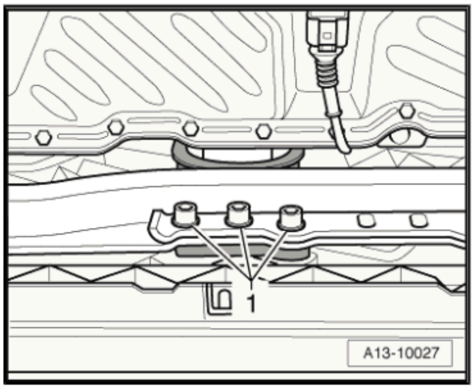
Installation is carried out in the reverse order; note the following:

Note

- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Install lock carrier with attachments ⇒ Rep. gr. 50 .

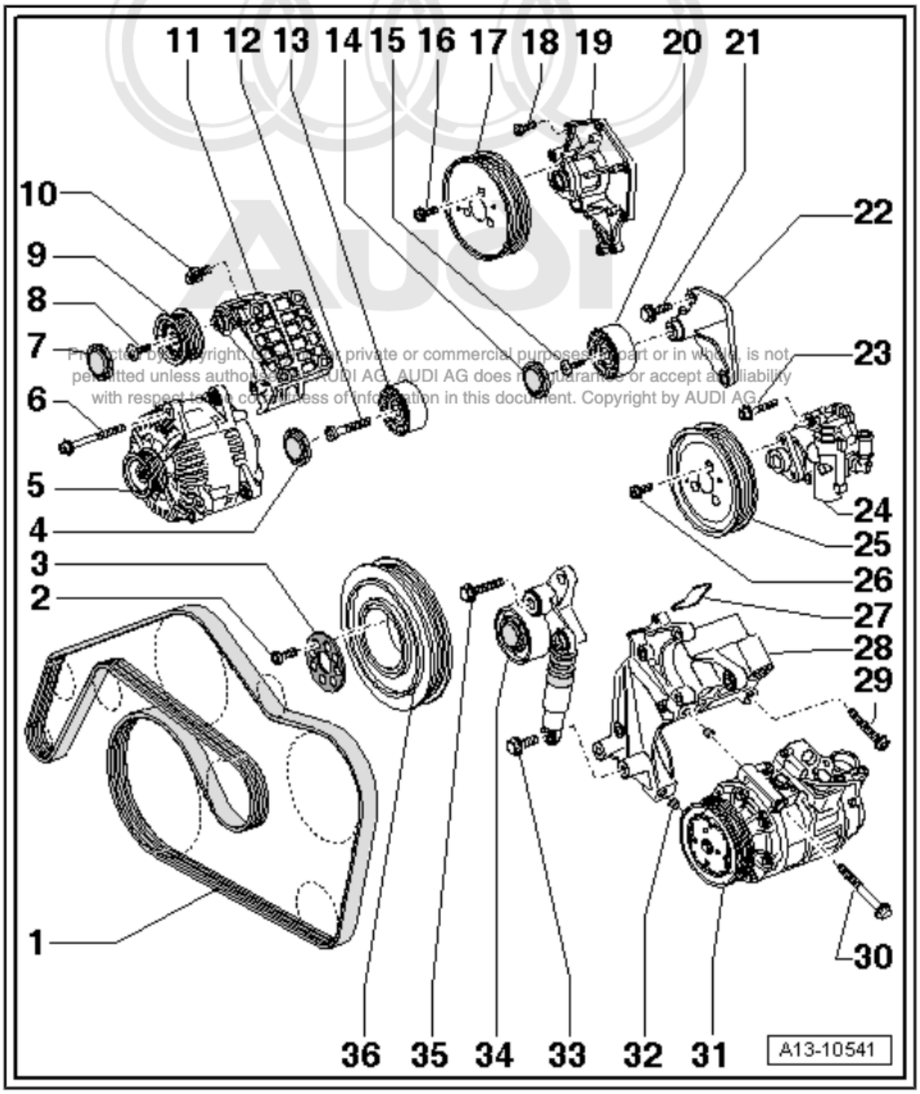
- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .



Tightening torques

Component		Nm
Torque reaction support bracket to air pipe (bottom)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.2 Poly V-belt drive - exploded view



1 - Poly V-belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ☐ Removing and installing ⇒ page 52
- ☐ Check for wear
- ☐ When installing, make sure it is properly seated on pulleys.

2 - 20 Nm + turn 90° further

- ☐ Property class 10.9
- ☐ Renew

3 - Shim

- ☐ Renew
- ☐ Must be fitted on all vehicles, even if no shim was fitted previously

4 - Cover for idler roller

5 - Alternator

- ☐ Removing and installing ⇒ Rep. gr. 27
- ☐ To facilitate attachment of alternator, knock back threaded bushes for alternator securing bolt slightly

6 - 23 Nm

7 - Cover for idler roller

8 - 23 Nm

- ☐ Property class 10.9

9 - Idler roller for poly V-belt

- ☐ Note installation position

10 - Bolt
  - ☐ Tightening torque and sequence ⇒ page 49

11 - Bracket for alternator and idler roller

12 - 23 Nm
  - ☐ Property class 10.9

13 - Idler roller for poly V-belt
  - ☐ Note installation position

14 - Cover for idler roller
  - ☐ On vehicles with additional idler roller

15 - 23 Nm
  - ☐ Property class 10.9
  - ☐ On vehicles with additional idler roller

16 - 23 Nm

17 - Poly V-belt pulley for coolant pump
  - ☐ Counterhold with pin wrench -3212- when loosening and tightening ⇒ page 49 .
  - ☐ Installation position: marking „vorne“ (front) faces in direction of travel.

18 - 9 Nm

19 - Coolant pump
  - ☐ Removing and installing ⇒ page 208

20 - Idler roller for poly V-belt
  - ☐ Only applicable on new versions:
  - ☐ Removing and installing ⇒ page 56

21 - 23 Nm
  - ☐ On vehicles with additional idler roller

22 - Bracket for idler roller
  - ☐ On vehicles with additional idler roller

23 - 23 Nm

24 - Power steering pump
  - ☐ Removing and installing ⇒ Rep. gr. 48

25 - Poly V-belt pulley for power steering pump
  - ☐ Counterhold with pin wrench -3212- when loosening and tightening ⇒ page 49 .
  - ☐ Installation position: marking „vorne“ (front) faces in direction of travel.

26 - 22 Nm

27 - Seal
  - ☐ Renew

28 - Bracket for ancillaries

29 - 40 Nm

30 - 25 Nm

31 - Air conditioner compressor
  - ☐ Do not unscrew or disconnect refrigerant hoses or pipes.
  - ☐ Removing and installing ⇒ Rep. gr. 87
  - ☐ When installing check dowel sleeves -item 32-

32 - Dowel sleeve
  - ☐ 2x
  - ☐ Check for correct seating in bracket

33 - 23 Nm

34 - Poly V-belt tensioner

> Caution
>
> *Depending on the vehicle version, an M10 or an M11 thread may have been used for the securing thread in the crankcase for the tensioner. It is very important that the correct bolt and tensioner to the crankcase is used. ⇒ Electronic parts catalogue*

☐ Removing and installing ⇒ page 49

35 - Bolt

> Caution
>
> *Different threads in crankcase.*
>
> *Before installation, check whether thread is M10 or M11 version.*
>
> *Use appropriate bolt size. Risk of damage to engine.*
>
> *It is very important that the correct bolt and tensioner to the crankcase is used. ⇒ Electronic parts catalogue*

☐ Bolt with M10 thread: 50 Nm + turn 90° further

☐ Bolt with M11 thread: 60 Nm + turn 90° further

☐ Renew

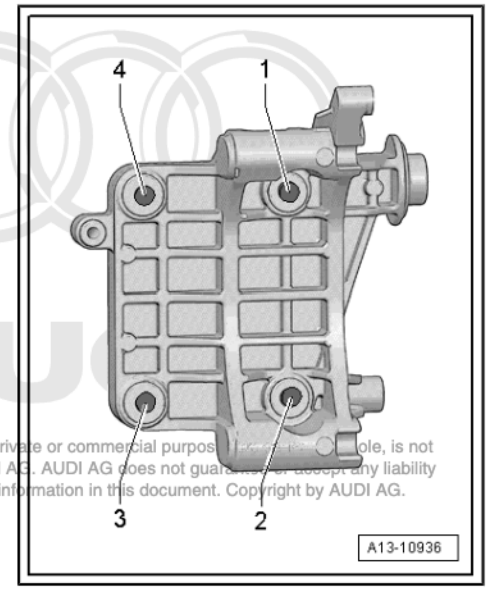
36 - Vibration damper

☐ With poly V-belt pulley

☐ Removing and installing ⇒ page 57

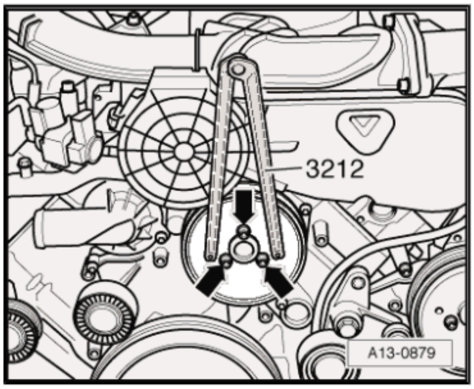
Bracket for alternator and idler roller - tightening torque and sequence

- – Fit bolts in the sequence -1 ... 4-.
- – Tighten bolts in the sequence -1 ... 4- to 40 Nm.



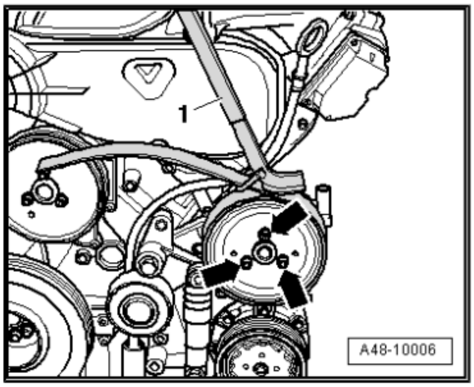
Loosening poly V-belt pulley for coolant pump

- Poly V-belt removed.
- – Counterhold using pin wrench -3212- when loosening bolts -arrows- on poly V-belt pulley for coolant pump.



Loosening poly V-belt pulley for power steering pump

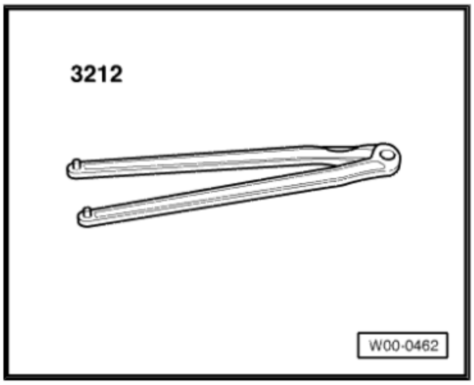
- Poly V-belt removed.
- – Counterhold using strap wrench when loosening bolts -arrows- on poly V-belt pulley for power steering pump.



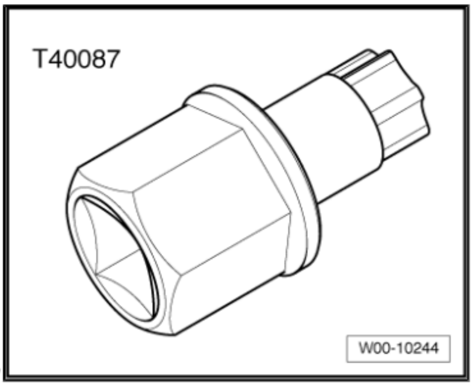
1.3 Removing and installing coolant pump pulley

Special tools and workshop equipment required

- Pin wrench -3212-



- Socket Torx T 60 -T40087-

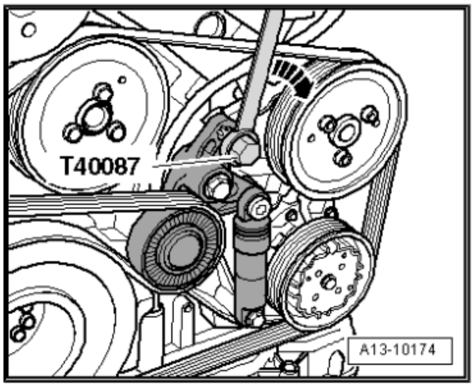


Removing

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

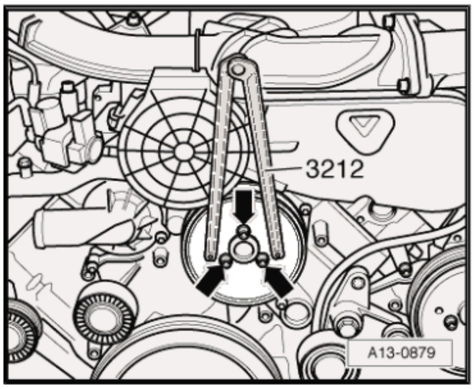
– Slacken poly V-belt by swivelling tensioner in direction of -arrow-, using socket Torx T 60 -T40087- and a long, straight-handled ring spanner or open-end spanner.

– Remove poly V-belt from coolant pump pulley



– Counterhold using pin wrench -3212- when loosening bolts -arrows-.

– Take poly V-belt pulley off coolant pump.



Installing

Installation is carried out in the reverse order; note the following:

- Installation position: marking „vorne“ (front) faces in direction of travel.

Note

When installing poly V-belt, make sure it is properly seated on pulleys.

– Install intake manifold (top section) ⇒ Rep. gr. 23 .

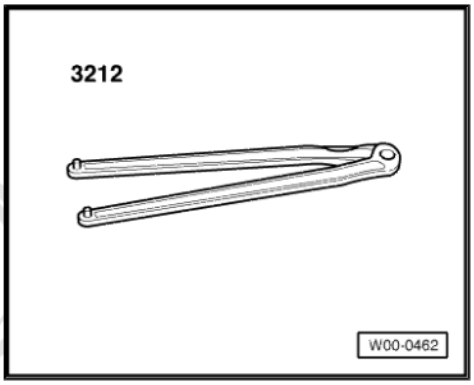
– Start engine and check that belt runs properly.

- Tightening torque ⇒ page 46

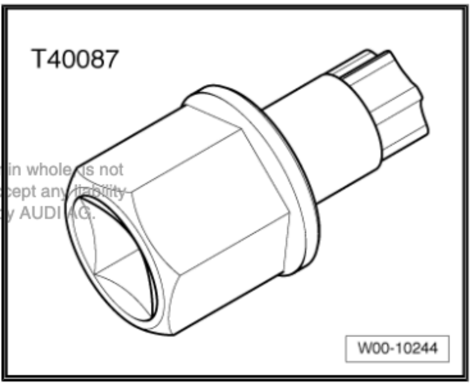
1.4 Removing and installing power steering pump pulley

Special tools and workshop equipment required

- Pin wrench -3212-

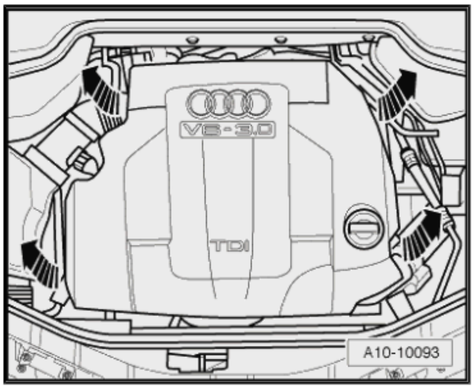


- Socket Torx T 60 -T40087-

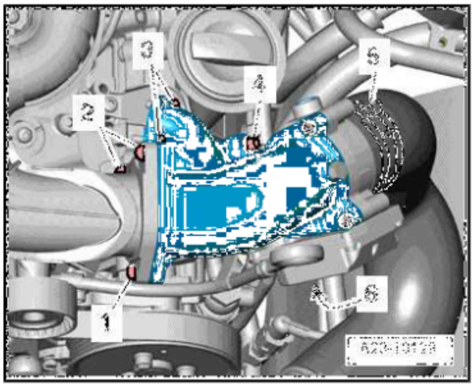


Removing

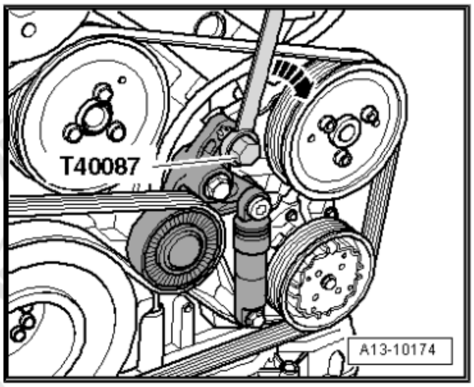
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



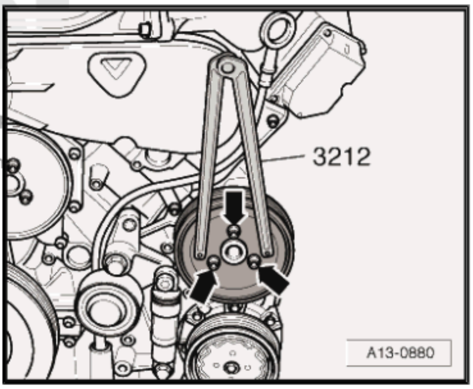
- Disconnect air intake hose -5- from throttle valve module -J338- .
- Unplug electrical connector -6- at throttle valve module -J338- .
- Remove bolts -1 … 4- and take out intake connecting pipe.



- Slacken poly V-belt by swivelling tensioner in direction of -arrow-, using socket Torx T 60 -T40087- and a long, straight-handled ring spanner or open-end spanner.
- Remove poly V-belt from power steering pump pulley.



- Counterhold using pin wrench -3212- when loosening bolts -arrows-.
- Take poly V-belt pulley off power steering pump.



Installing

Installation is carried out in the reverse order; note the following:

- Installation position: marking „vorne“ (front) faces in direction of travel.

Note

- *Renew seals and gaskets.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *When installing poly V-belt, make sure it is properly seated on pulleys.*

- Start engine and check that belt runs properly.
- Tightening torque ⇒ page 46

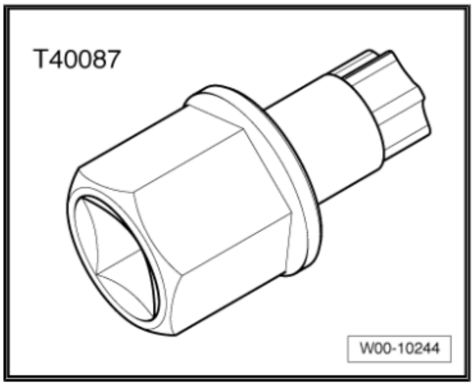
Further tightening torques

Component		Nm
Intake connecting pipe to intake manifold (top section)		9
Connecting pipe for exhaust gas recirculation to intake connecting pipe		9
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.5 Removing and installing poly V-belt

Special tools and workshop equipment required

- Socket Torx T 60 -T40087-

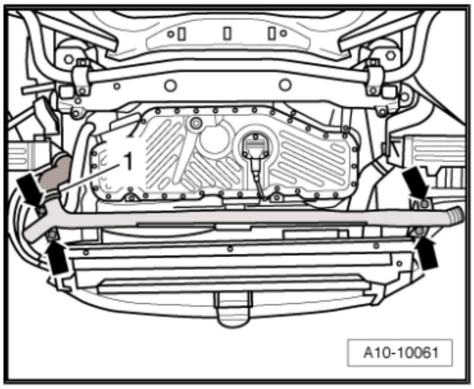


Removing

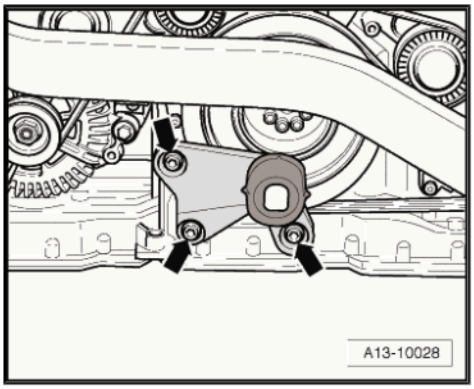
– Move lock carrier to service position ⇒ page 43 .

– Disconnect hose -1-.

– Unscrew bolts -arrows- and take out air pipe (bottom).

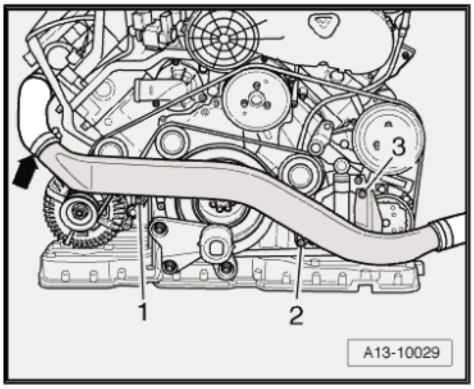


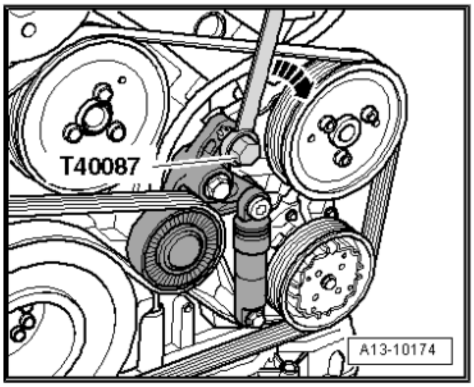
– Unscrew bolts -arrows- and detach torque reaction support from engine.



– Disconnect air intake hose -arrow- from air pipe (top).

– Unscrew bolts -1 ... 3- and detach air pipe (top) from engine.





Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

– Slacken poly V-belt by swivelling tensioner in direction of -arrow-, using socket Torx T 60 -T40087- and a long, straight-handled ring spanner or open-end spanner.

– Remove poly V-belt.

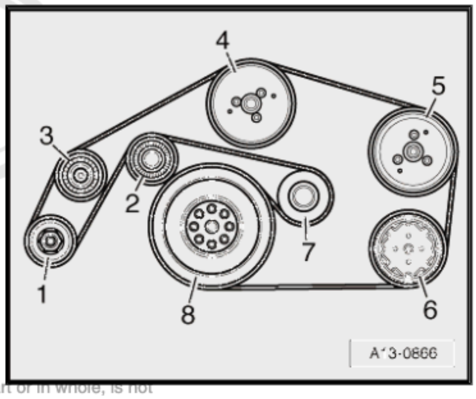
Installing

Installation is carried out in the reverse order; note the following:

Note

- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Fit poly V-belt on pulleys.



Vehicles without additional idler roller:

1 - Alternator

2 - Idler roller

3 - Idler roller

4 - Coolant pump

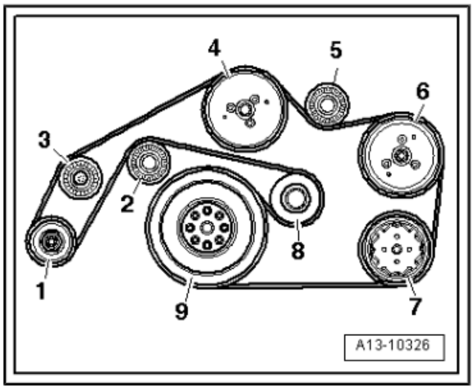
5 - Power steering pump

6 - Air conditioner compressor

7 - Poly V-belt tensioner

8 - Crankshaft

Vehicles with additional idler roller:



1 - Alternator

2 - Idler roller

3 - Idler roller

4 - Coolant pump

5 - Idler roller

6 - Power steering pump

7 - Air conditioner compressor

8 - Poly V-belt tensioner

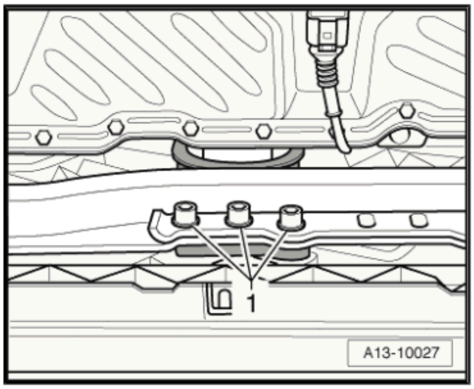
9 - Crankshaft

All vehicles:

Note

When installing poly V-belt, make sure it is properly seated on pulleys.

– Install lock carrier with attachments ⇒ Rep. gr. 50 .



– Slacken bolts -1-.

– Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.

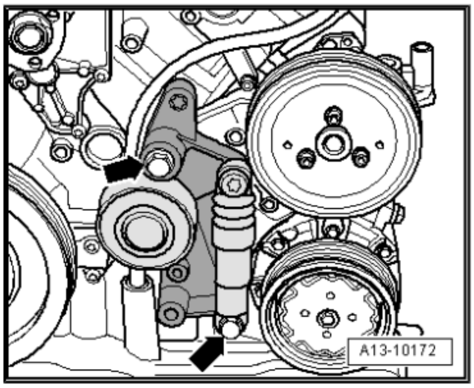
– Start engine and check that belt runs properly.

– Install bumper cover (front) ⇒ Rep. gr. 63 .

Tightening torques

Component		Nm
Air pipe (top) to engine		9
Torque reaction support to engine		40
Air pipe (bottom) to longitudinal member		40
Torque reaction support bracket to air pipe (bottom)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.6 Removing and installing tensioner for poly V-belt



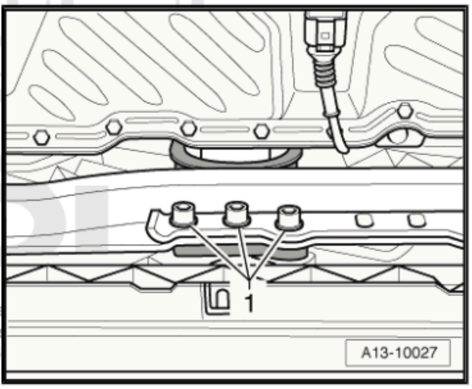
Removing

- Move lock carrier to service position ⇒ page 43 .
- Remove poly V-belt ⇒ page 52 .
- Remove poly V-belt pulley for coolant pump ⇒ page 49 .
- Remove bolts -arrows-.
- Detach poly V-belt tensioner.

Installing

Installation is carried out in the reverse order; note the following:

- Install poly V-belt ⇒ page 52 .
- Install intake manifold (top section) ⇒ Rep. gr. 23 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Tightening torques ⇒ page 46

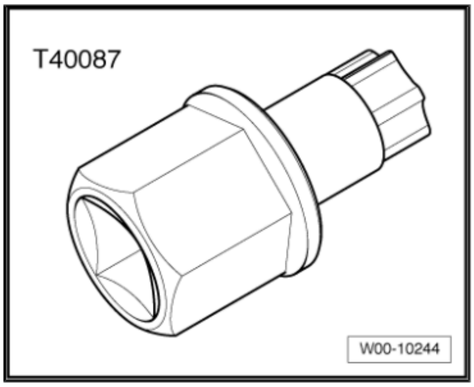
Further tightening torques

Component		Nm
Air pipe (top) to engine		9
Torque reaction support to engine		40
Air pipe (bottom) to longitudinal member		40
Torque reaction support bracket to air pipe (bottom)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.7 Removing and installing idler roller for poly V-belt

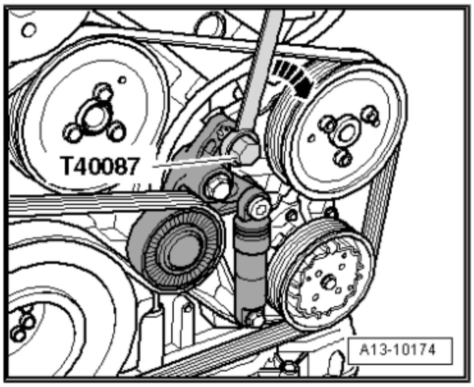
Special tools and workshop equipment required

- Socket Torx T 60 -T40087-



Removing

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

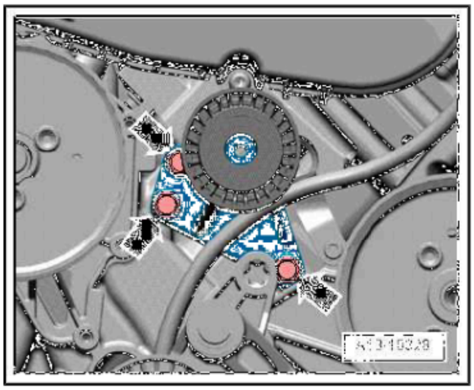


Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

– Slacken poly V-belt by swivelling tensioner in direction of -arrow-, using socket Torx T 60 -T40087- and a long, straight-handled ring spanner or open-end spanner.

– Remove poly V-belt from tensioning roller.



– Unscrew bolts -arrows- and detach idler roller from front sealing flange.

Installing

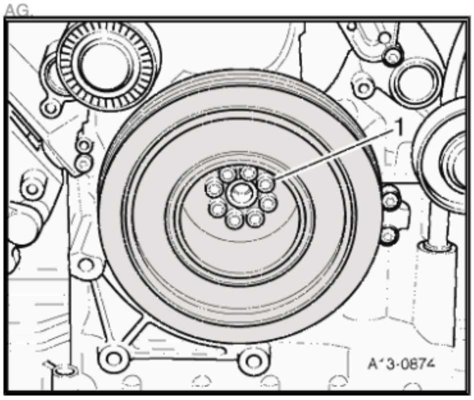
Installation is carried out in the reverse order; note the following:

– Install poly V-belt ⇒ page 52 .

– Install intake manifold (top section) ⇒ Rep. gr. 23 .

- Tightening torque ⇒ page 46

1.8 Removing and installing vibration damper



Removing

– Move lock carrier to service position ⇒ page 43 .

– Remove poly V-belt ⇒ page 52 .

– Mark position of vibration damper for re-installation.

– Remove bolts -1-.

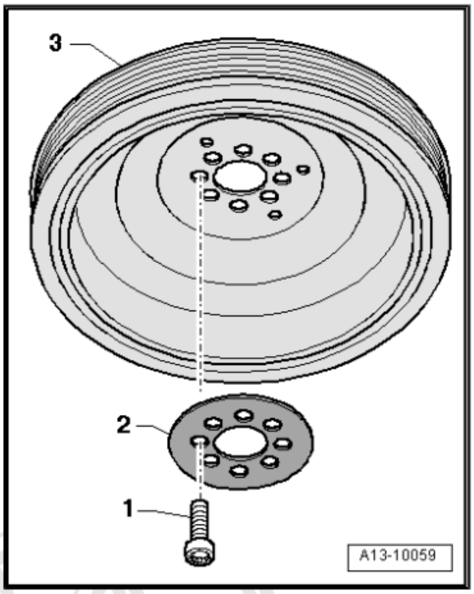
– Remove vibration damper.

Installing

Installation is carried out in the reverse order; note the following:

Note

- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Renew bolts -1- for vibration damper.*

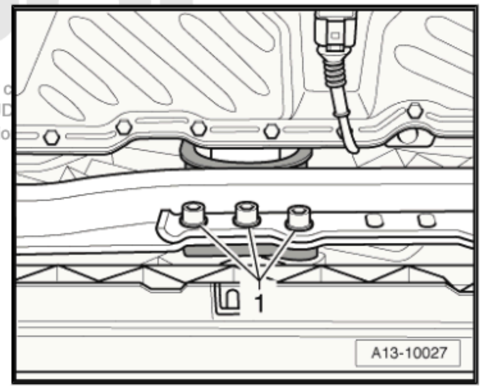


– Install vibration damper -3- with new shim -2-.

> Caution
>
> *The shim must be installed on all vehicles, even if no shim was fitted previously.*

– Install poly V-belt ⇒ page 52 .

– Install lock carrier with attachments ⇒ Rep. gr. 50 .



– Slacken bolts -1-.

– Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.

– Install bumper cover (front) ⇒ Rep. gr. 63 .

- Tightening torque ⇒ page 46

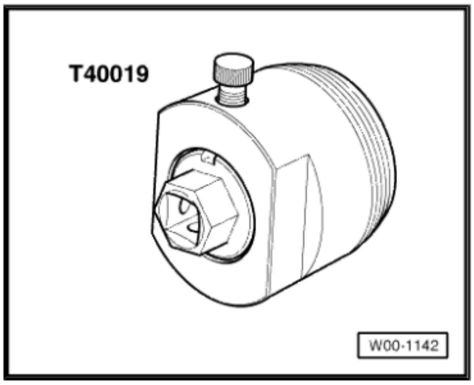
Further tightening torques

Component		Nm
Air pipe (top) to engine		9
Torque reaction support to engine		40
Air pipe (bottom) to longitudinal member		40
Torque reaction support bracket to air pipe (bottom)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

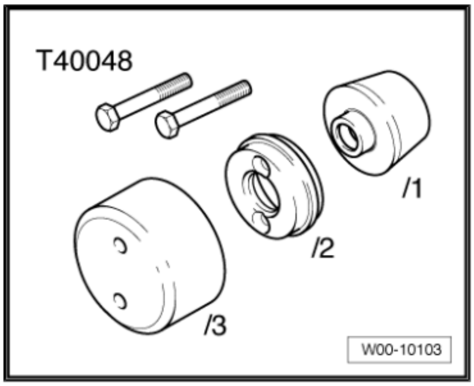
1.9 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

- Oil seal extractor -T40019-

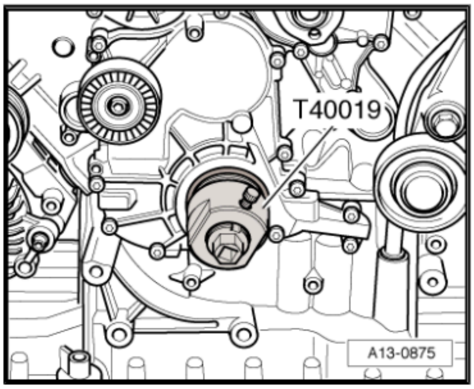


- Assembly appliance -T40048- with -T40048/4-

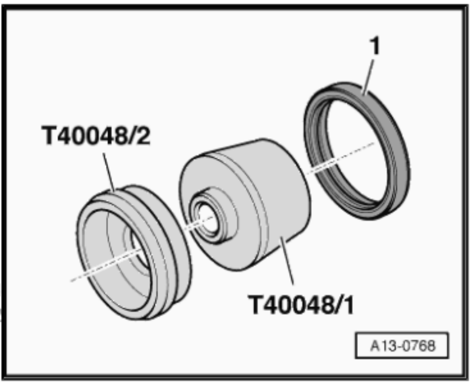


Procedure

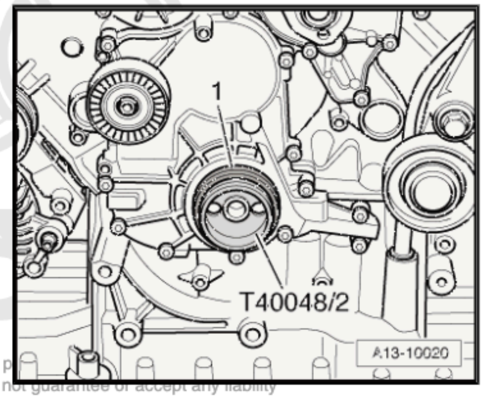
- Move lock carrier to service position ⇒ page 43 .
- Remove poly V-belt ⇒ page 52 .
- Remove vibration damper ⇒ page 57 .
- Adjust the inner part of oil seal extractor -T40019- so it is flush with the outer part and lock in position with knurled screw.



- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean contact surface and sealing surface.
- Fit assembly aid -T40048/1- onto assembly sleeve -T40048/2- and slide oil seal -1- onto assembly sleeve.
- Take off assembly aid.



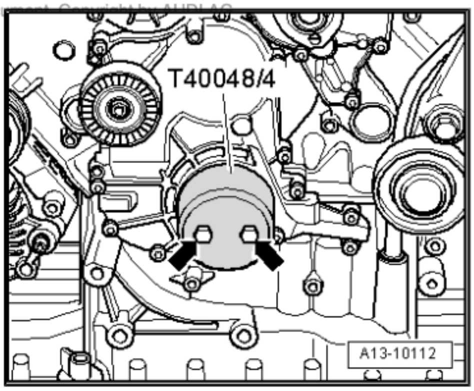
- Fit assembly sleeve -T40048/2- on crankshaft and slide oil seal -1- into sealing surface in engine.



Note

Leave assembly sleeve -T40048/2- in position on crankshaft for pressing in seal.

- Apply press sleeve -T40048/4- (installation depth 5 mm) to crankshaft using two M8×55 mm bolts -arrows-.
- Screw in bolts hand-tight to start with.
- Tighten bolts alternately, $^{1}/_{2}$ turn at a time, to press in oil seal onto stop.



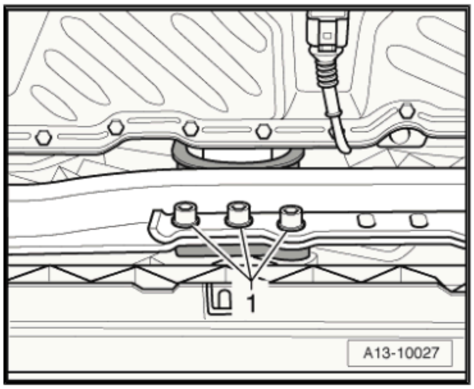
Remaining installation steps are carried out in reverse sequence; note the following:

Note

- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Install vibration damper ⇒ page 57 .
- Install poly V-belt ⇒ page 52 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .

- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .



Tightening torques

Component		Nm
Air pipe (top) to engine		9
Torque reaction support to engine		40
Air pipe (bottom) to longitudinal member		40
Torque reaction support bracket to air pipe (bottom)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

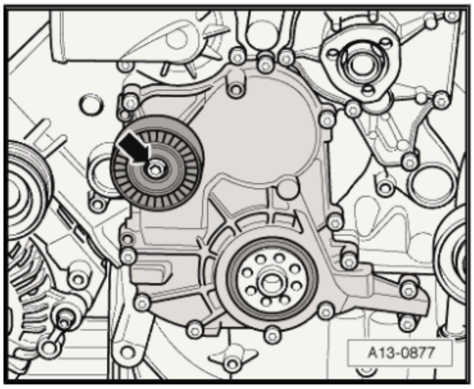
1.10 Removing and installing sealing flange (front)

Special tools and workshop equipment required

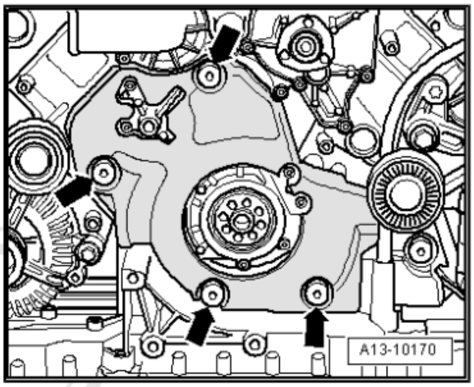
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Parts catalogue

Removing

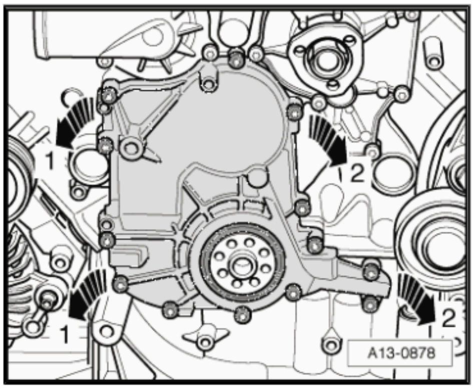
- Drain off coolant ⇒ page 202 .
- Move lock carrier to service position ⇒ page 43 .
- Remove poly V-belt ⇒ page 52 .
- Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Remove coolant pipe (right-side, centre) ⇒ page 220 .
- Remove poly V-belt pulley for coolant pump ⇒ page 49 .
- Remove vibration damper ⇒ page 57 .
- Pry off cover from idler roller for poly V-belt.
- Unscrew bolt -arrow- and detach idler roller from front sealing flange.



- Detach noise insulation panel at front sealing flange -arrows-.



- Remove bolts.
- Pull off front sealing flange (right-side first -arrow 1-, then left-side -arrow 2-).
- Drive out oil seal with flange removed.



Installing

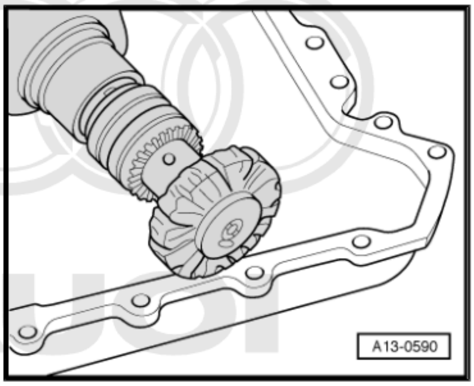
Installation is carried out in the reverse order; note the following:

Note

- ♦ *Renew seals and O-rings.*
- ♦ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ♦ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

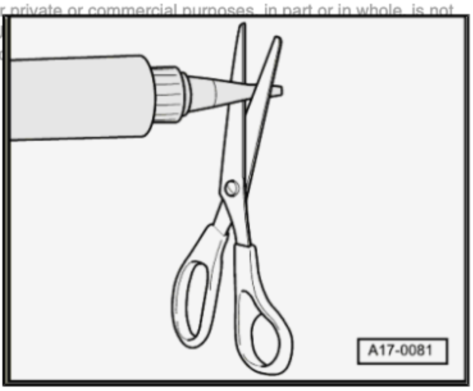
- Remove old sealant from grooves in sealing flange and from sealing surfaces.

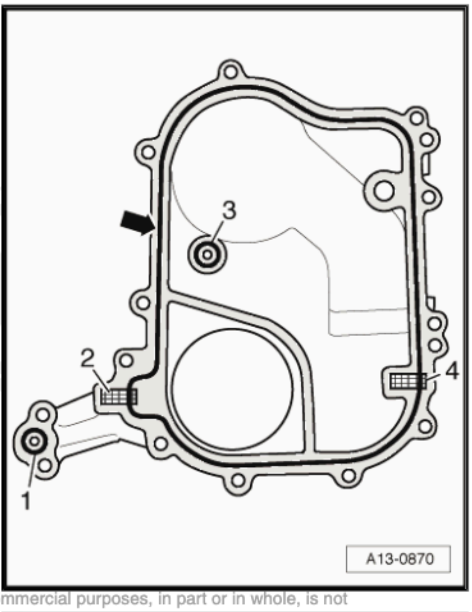
> WARNING
>
> *Wear safety goggles.*



- Remove remaining sealant from sealing flange and cylinder block/sump (top section) with rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.

- Cut off nozzle of tube at front marking (∅ of nozzle approx. 2 mm).



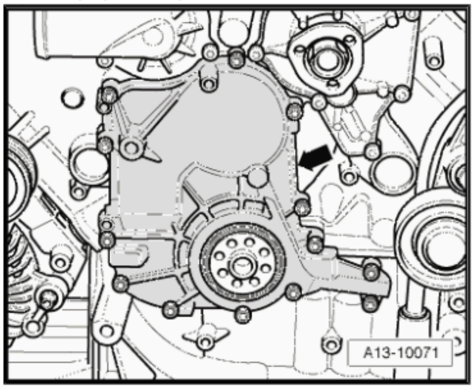


- Install sealing elements -2- and -4- and O-rings -1- and -3-.
- Apply bead of sealant -arrow- onto clean sealing surface of front sealing flange, as illustrated.

• The bead of sealant must project 1.5 … 2.0 mm above the sealing surface.

Note

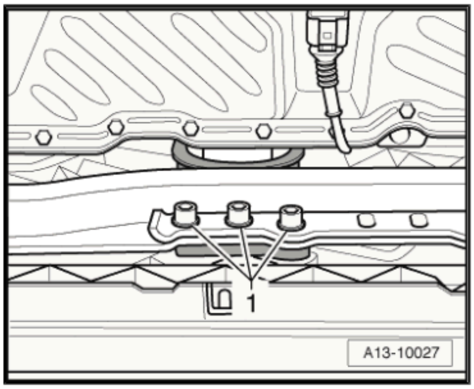
- ♦ *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- ♦ *The front sealing flange must be installed within 5 minutes after applying sealant.*



- Tighten bolts securing front sealing flange -arrow- in diagonal sequence and in stages.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install crankshaft oil seal (pulley end) ⇒ page 58 .
- Install poly V-belt pulley for coolant pump ⇒ page 49 .
- Install vibration damper ⇒ page 57 .
- Install poly V-belt ⇒ page 52 .
- Install coolant pipe (right-side) ⇒ page 220 .
- Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .

Tightening torques

Component		Nm
Front sealing flange to cylinder block		9
Idler roller to sealing flange		23
Bracket for torque reaction support to cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

2 Servicing work on gearbox end

2.1 Vacuum pump - exploded view

1 - 9 Nm

2 - Vacuum pump

- ❑ Removing and installing ⇒ page 64

3 - Vacuum hose

- ❑ Secure with correct type of hose clips (as original equipment) ⇒ Parts catalogue

4 - 5 Nm

5 - O-ring

- ❑ Renew

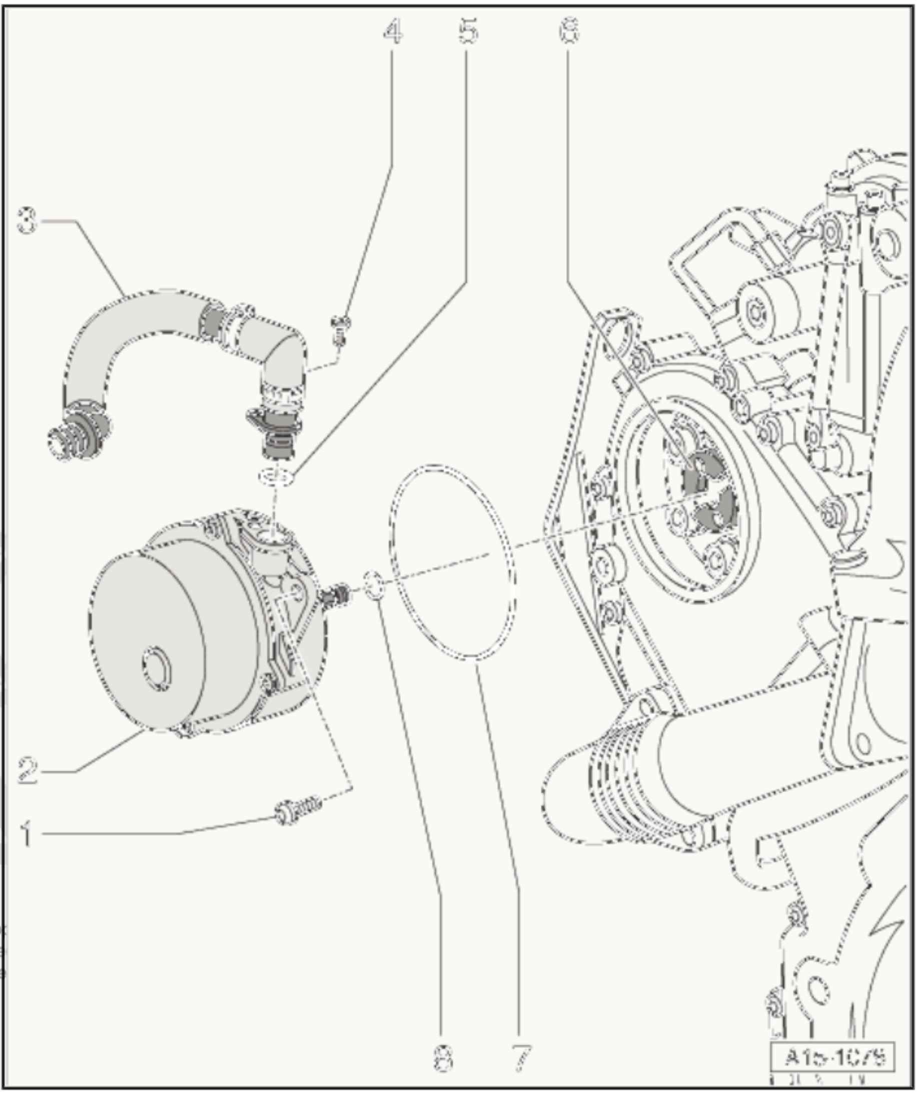
6 - Inlet camshaft

7 - O-ring

- ❑ Renew

8 - O-ring

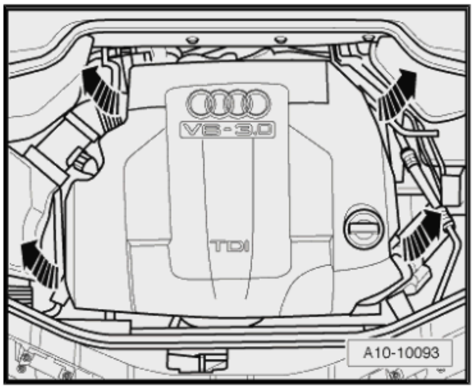
- ❑ Renew



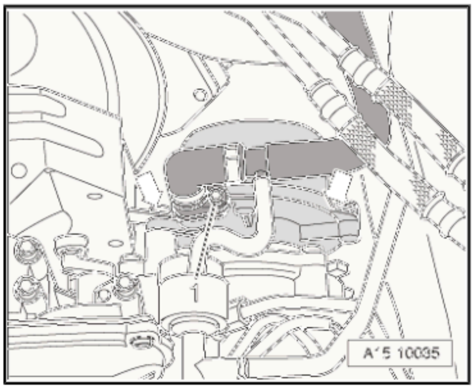
2.2 Removing and installing vacuum pump

Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



- Unscrew bolt -1- and pull out vacuum hose at vacuum pump together with hose connection.
- Unscrew bolts -arrows- and remove vacuum pump.



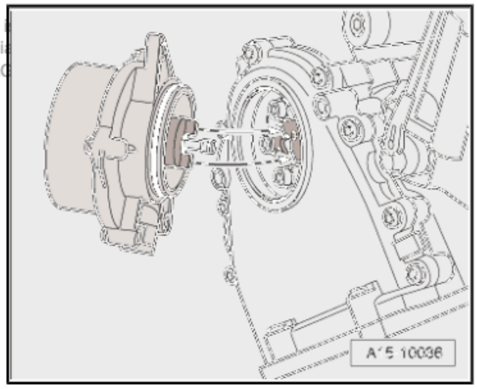
Installing

Installation is carried out in the reverse order; note the following:

Note

Renew O-rings.

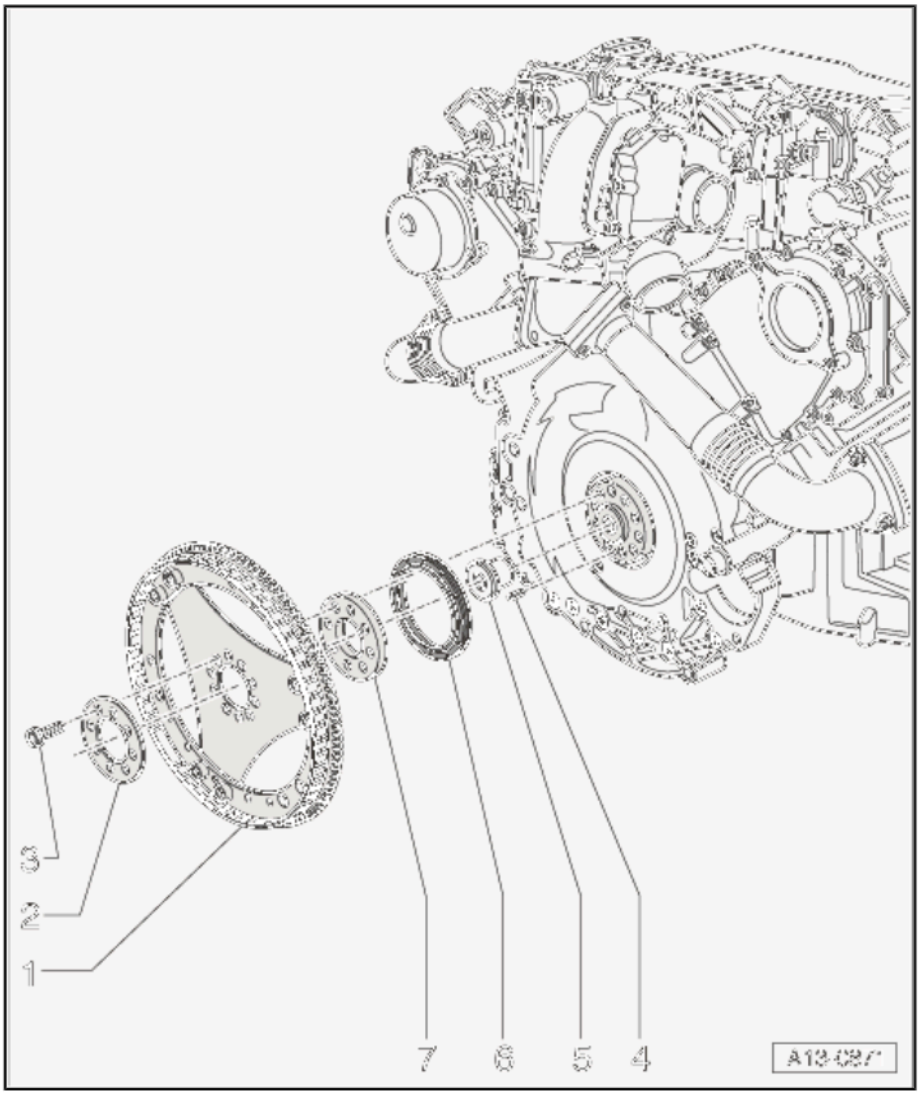
- Set drive lugs of vacuum pump so they engage in slots on camshaft when pump is fitted -arrow-.



Tightening torques

Component	Nm
Vacuum pump to timing chain cover	9
Vacuum hose connection to vacuum pump	5

2.3 Drive plate - exploded view



1 - Drive plate
- ❑ Removing and installing ⇒ page 66
- ❑ After renewing the drive plate on vehicles up to approx. 01.2006 the pin assignment for engine speed sender -G28- must be altered accordingly ⇒ page 67

2 - Washer
- ❑ Thickness 1.5 mm

3 - 30 Nm + 90° ($^1/_4$ turn) further
- ❑ Renew

4 - Dowel sleeve

5 - Centring sleeve for torque converter

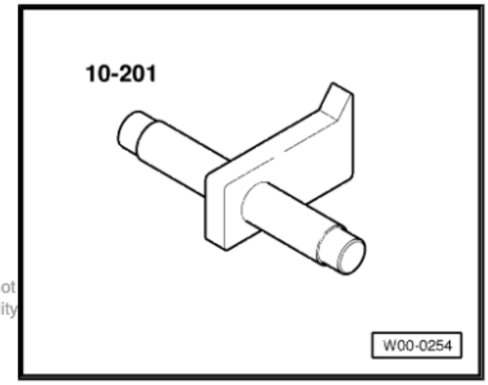
6 - Crankshaft oil seal (on timing chain end)
- ❑ Removing and installing ⇒ page 67

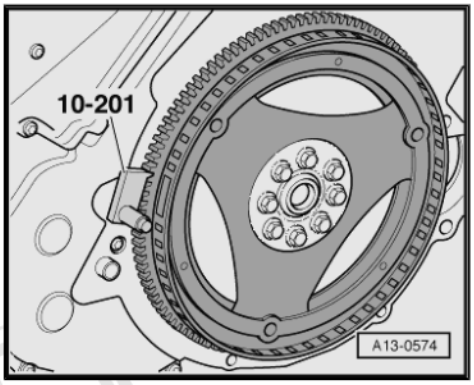
7 - Shim
- ❑ Thickness 1.5 mm

2.4 Removing and installing drive plate

Special tools and workshop equipment required

- ◆ Counterhold tool -10 - 201-





Removing

- Engine/gearbox removed.

– Mark installation position of drive plate on crankshaft.

– Attach counterhold tool -10 - 201- in order to loosen bolts.

– Unbolt drive plate.

– Take out shim located behind.

Installing

Installation is carried out in the reverse order; note the following:

– Fit shim (1.5 mm) onto crankshaft.

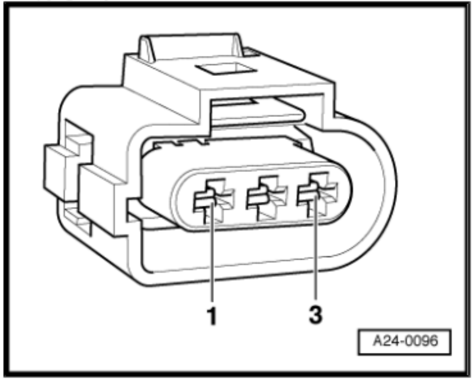
– Install drive plate with washer (1.5 mm).

– Use new securing bolts.

– Reverse position of counterhold tool -10 - 201- in order to tighten bolts.

Vehicles up to approx. 01.2006:

If the drive plate -059 105 323 AG- has to be replaced, only the drive plate -059 105 323 AL- is available as a replacement part. When this new drive plate has been installed, the pin assignment of the electrical connector for engine speed sender -G28- must be altered as follows:

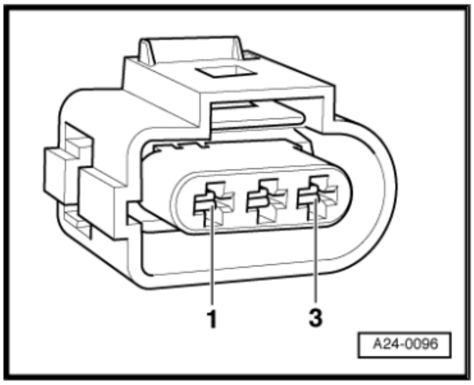


◆ Pin assignment (old) for engine speed sender -G28- in combination with drive plate -059 105 323 AG-

1 - Black

2 - Yellow

3 - Green



◆ Pin assignment (new) for engine speed sender -G28- in combination with drive plate -059 105 323 AL-

1 - Black

2 - Green

3 - Yellow

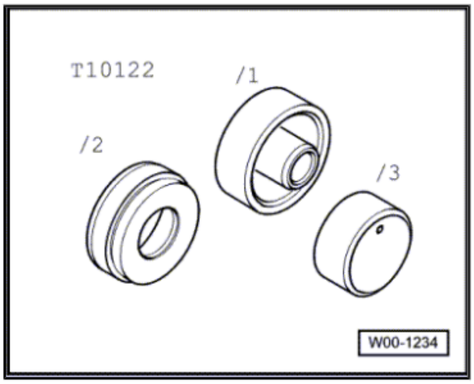
Tightening torque

Component	Nm
Drive plate to crankshaft	30 + 90° [1)2)]
- 1) Renew bolts. - 2) 90° = one quarter turn.	

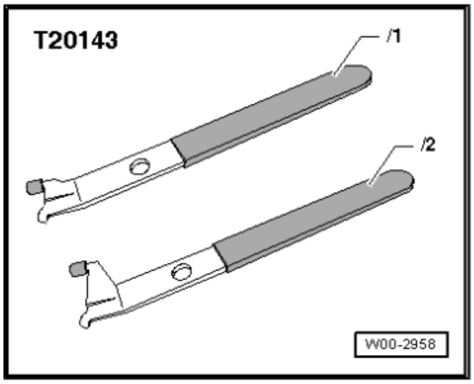
2.5 Renewing crankshaft oil seal (timing chain end)

Special tools and workshop equipment required

◆ Fitting tool -T10122-



◆ Extractor tool -T20143-

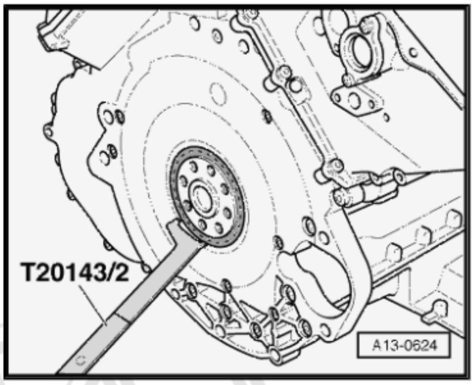


Procedure

- Engine/gearbox removed.

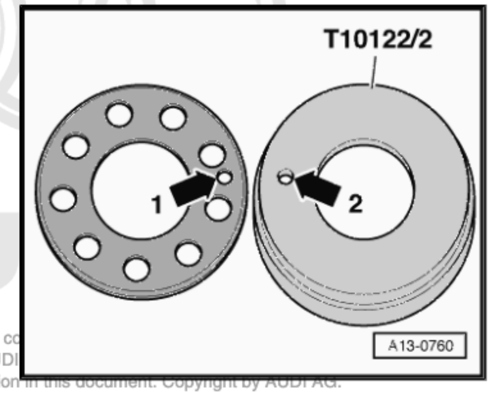
– Remove drive plate ⇒ page 66 .

– Pry out oil seal using extractor tool -T20143/2- .

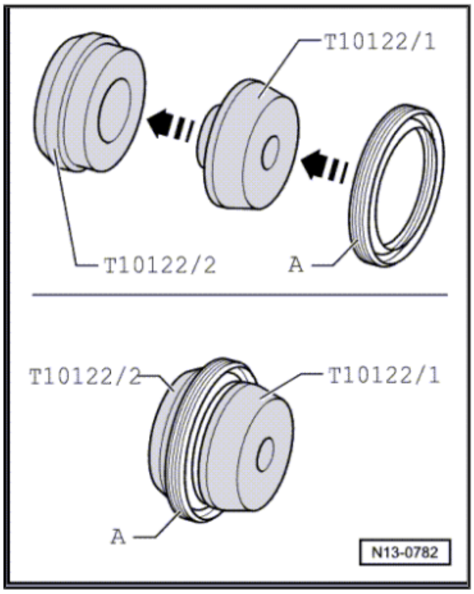


– Modify assembly sleeve -T10122/2- by drilling an 8 mm ∅ hole -arrow 2- for the dowel sleeve.

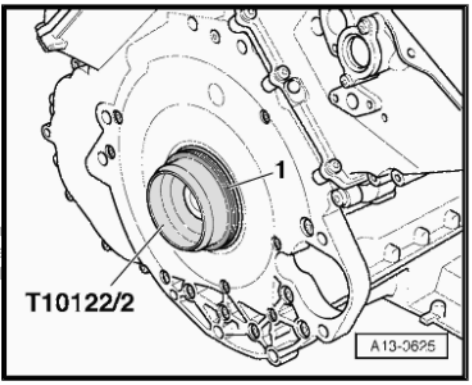
– Use hole -arrow 1- in washer as a drilling template.



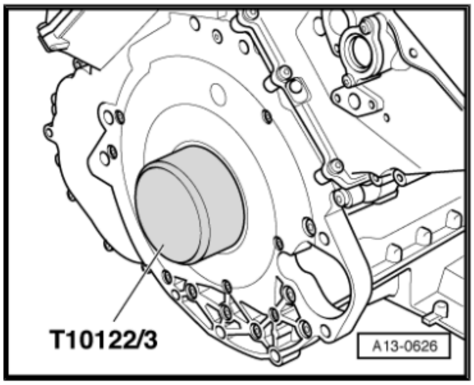
- Clean running surface and sealing surface.
- Fit assembly aid -T10122/1- onto assembly sleeve -T10122/2- and slide oil seal -A- onto assembly sleeve.
- Take off assembly aid.



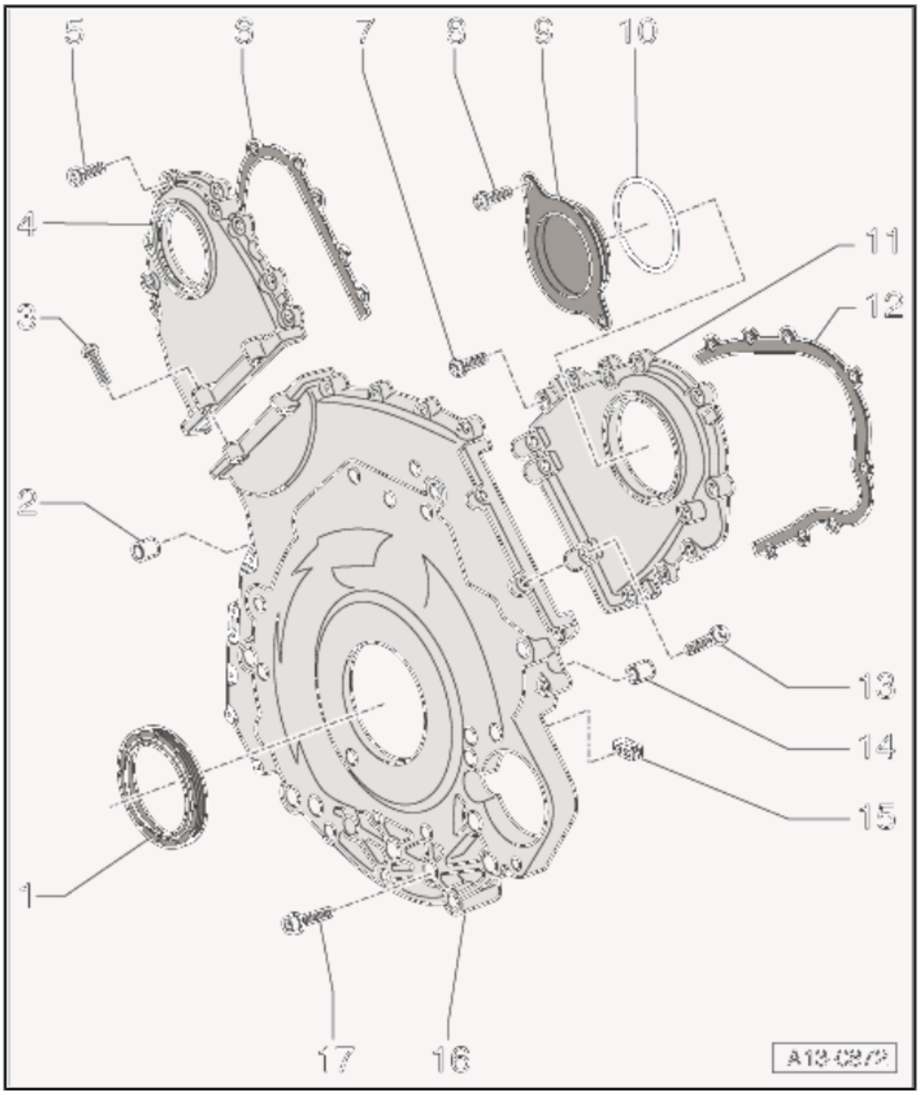
- Fit assembly sleeve with oil seal onto crankshaft.



- Press in the oil seal with thrust sleeve -T10122/3- evenly so that it is flush all round.
- Install drive plate ⇒ page 66 .



2.6 Timing chain covers - exploded view



1 - Crankshaft oil seal (on timing chain end)
- ❑ Removing and installing ⇒ page 67

2 - Dowel sleeve
- ❑ 2x

3 - Bolt
- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 77

4 - Timing chain cover (left-side)

5 - Bolt
- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 77

6 - Gasket
- ❑ Renew

7 - Bolt
- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 77

8 - 9 Nm

9 - Cover plate

10 - O-ring
- ❑ Renew

11 - Timing chain cover (right-side)

12 - Gasket
- ❑ Renew

13 - Bolt
- ❑ Renew
- ❑ Note correct sequence when tightening ⇒ page 77

14 - Dowel sleeve
- ❑ 2x

15 - Sealing element
- ❑ 2x

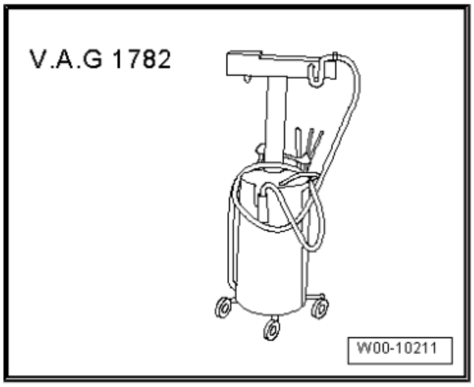
16 - Timing chain cover (bottom)

17 - M6 = 9 Nm; M8 = 23 Nm
- ❑ Note correct sequence when tightening ⇒ page 76

2.7 Removing and installing timing chain covers

Special tools and workshop equipment required

- Used oil collection and extraction unit -V.A.G 1782-

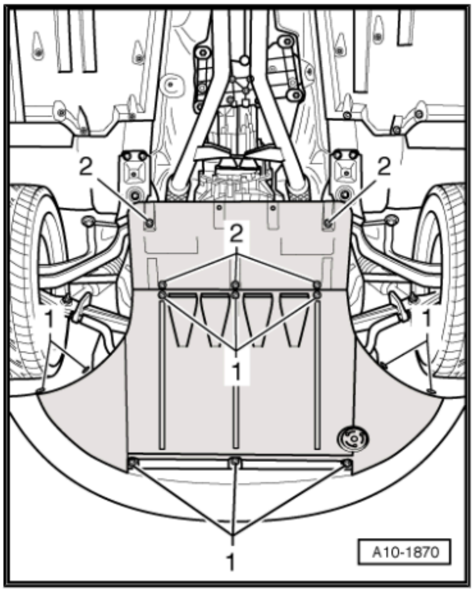


- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Parts catalogue

Removing

Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.



– Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.

– Place used oil collection and extraction unit -V.A.G 1782- under engine.

– Drain off engine oil.

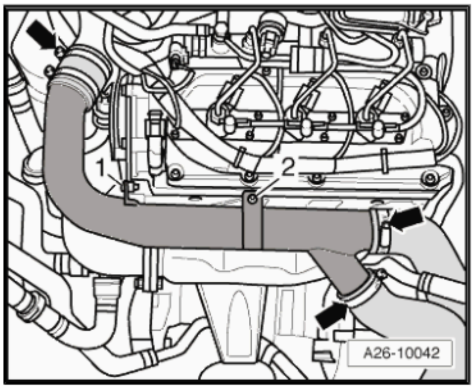
– Remove engine ⇒ page 8 .

– Separate engine from gearbox ⇒ page 27 .

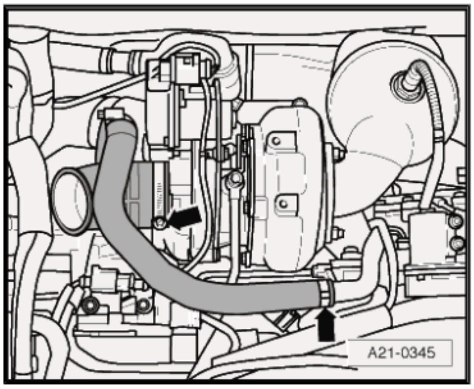
– Secure engine to engine and gearbox support ⇒ page 34 , or leave engine on scissor-type assembly platform -VAS 6131 A- .

– Remove drive plate ⇒ page 66 .

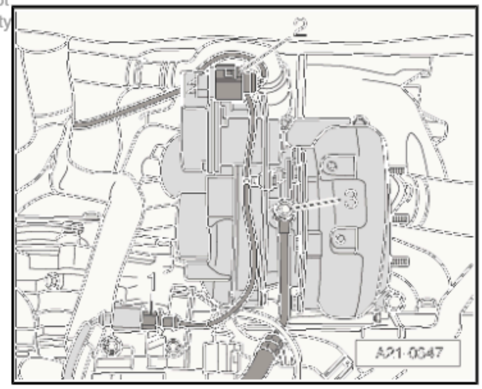
- Unscrew bolts -1- and -2- and disconnect air pipe from hoses -arrow-.



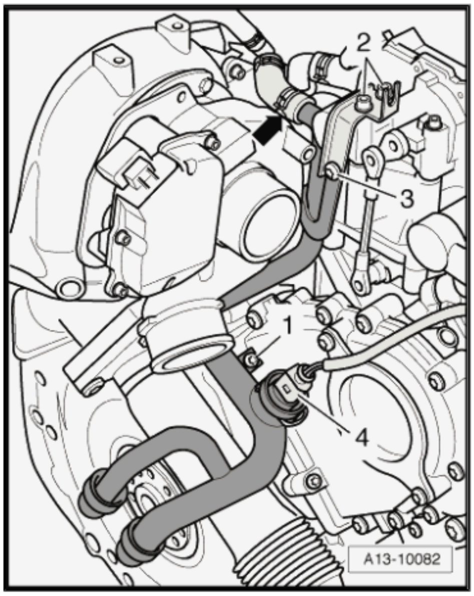
- Remove air intake hose together with crankcase breather hose -arrows-.



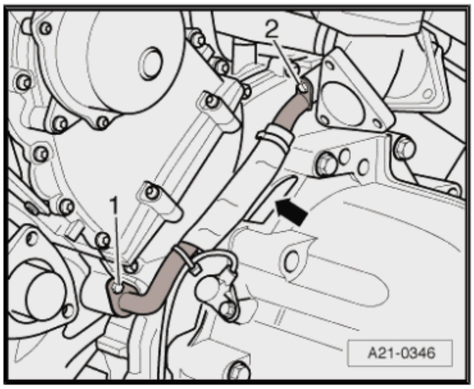
- Unplug electrical connectors -1- and -2-.
- Unscrew banjo bolt -3- for oil supply line.



- Unplug electrical connector -4-.
- Remove bolts -2- and -3- and detach bracket.
- Remove bolt -1-.
- Detach coolant pipe (rear) from coolant hose -arrow-.



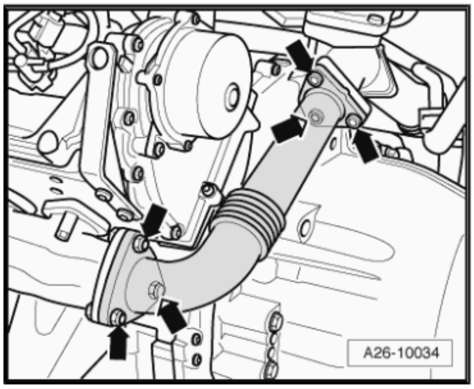
- Unscrew bolts -1- and -2- and detach oil return line.



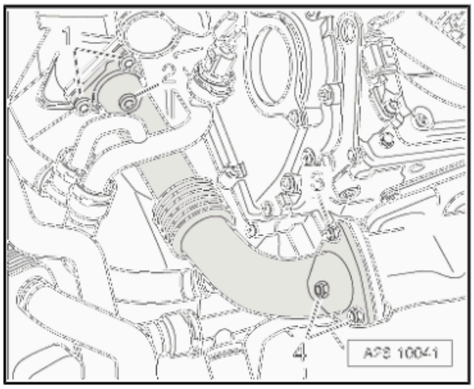
Note

Shown in illustration with intermediate pipe removed.

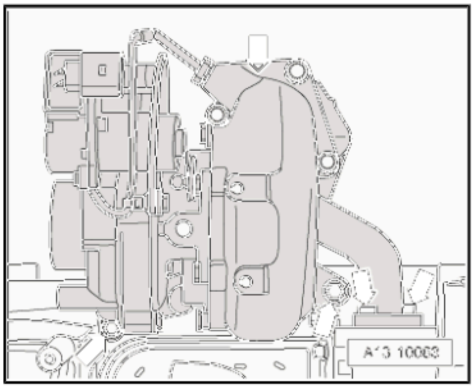
- Unscrew nuts and bolts -arrows- and detach intermediate pipe (left-side).



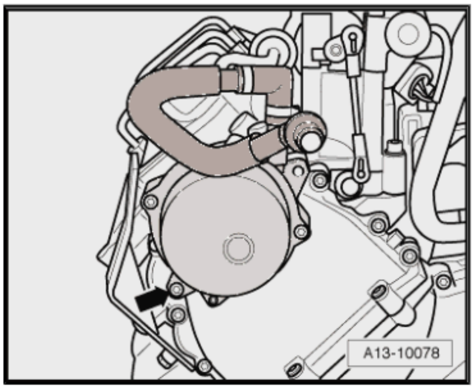
- Unscrew bolts and nuts -1 … 4- and detach intermediate pipe (right-side).



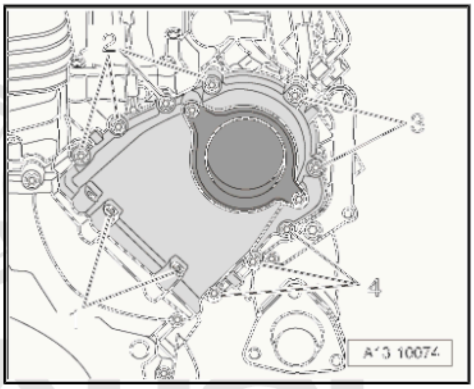
- Unscrew bolts -arrows- and detach turbocharger.



- Unscrew bolt -arrow- and detach vacuum pump.



- Remove bolts -1 ... 4- and detach timing chain cover (right-side).



- Remove bolts -1 ... 4- and detach timing chain cover (left-side).

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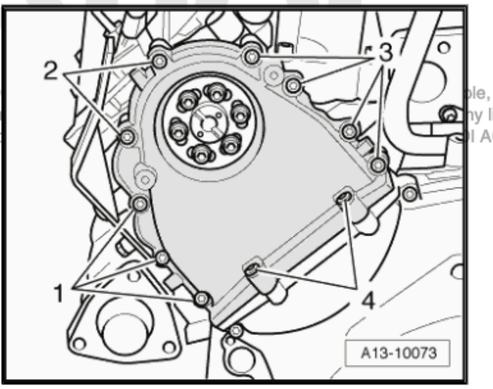
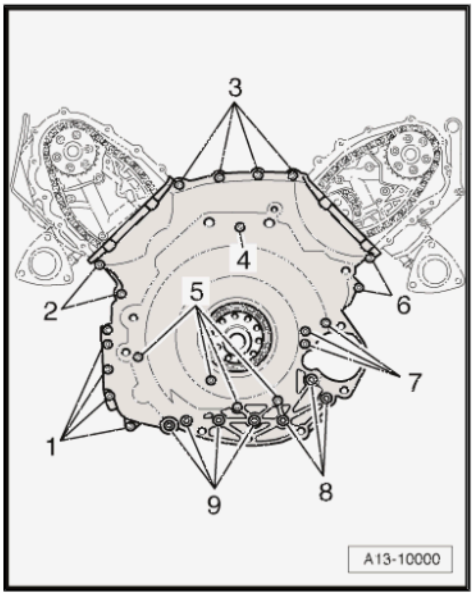


- Unscrew bolts -1 … 9- and remove timing chain cover (bottom).
- Press out crankshaft oil seal (rear) from timing chain cover.



Installing

Note

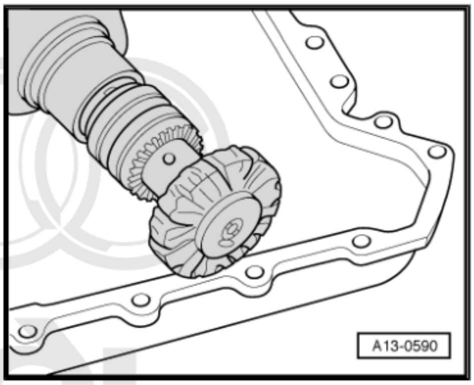
- *Renew gaskets, seals and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Reinstall all cable ties in the same locations when assembling.*

- Remove old sealant from grooves in timing chain covers and from sealing surfaces.

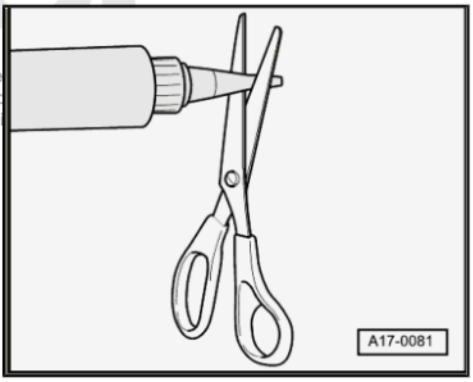
WARNING

Wear safety goggles.

- – Remove remaining sealant on timing chain covers and cylinder block / cylinder head using rotating plastic brush or similar.
- – Clean sealing surfaces; they must be free of oil and grease.



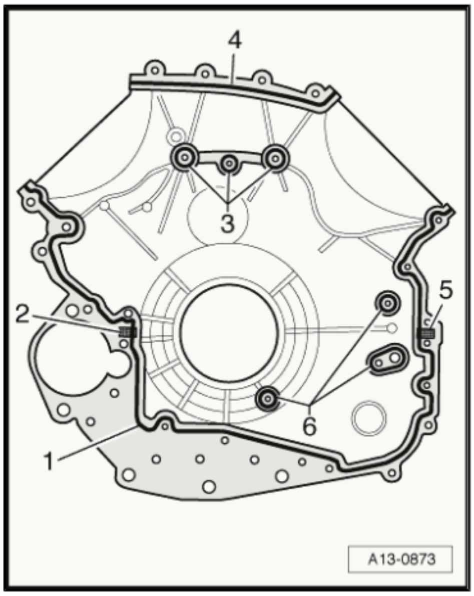
- – Cut off nozzle of tube at front marking (∅ of nozzle approx. 1.5 mm).



Note

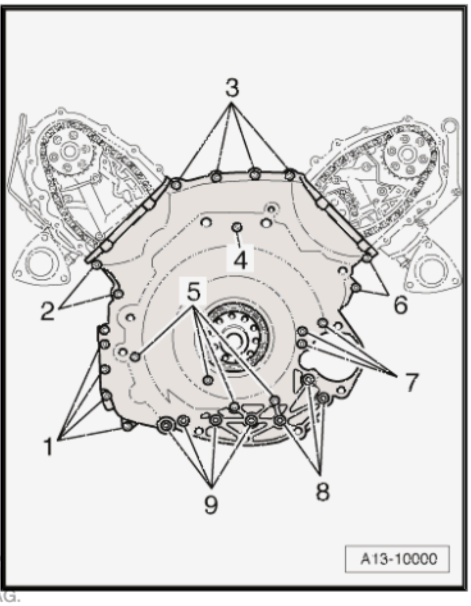
- ♦ *The sealant beads must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- ♦ *The timing chain covers must be installed within 5 minutes after applying sealant.*

- – Insert sealing elements -2- and -5-
- – Apply sealant beads -1- and -4- onto the clean sealing surface of the timing chain cover (bottom) as illustrated.
- • The grooves on the sealing surfaces must be completely filled with sealant.
- • The bead of sealant must project 1.5 … 2.0 mm above the sealing surface.
- • The beads of sealant around drillings -3- and -6- must be 1.5 … 2.0 mm thick.
- – Check whether the two dowel sleeves are fitted in the cylinder block; install if necessary.



– Fit timing chain cover (bottom) and tighten bolts as follows:

Stage	Tighten
I	– Pre-tighten bolts -1 … 9- to 5 Nm in diagonal sequence starting from inside and working outwards.
II	– Tighten bolts -1 … 7- to 9 Nm in diagonal sequence starting from inside and working outwards.
III	– Tighten bolts -8- and -9- to 23 Nm.

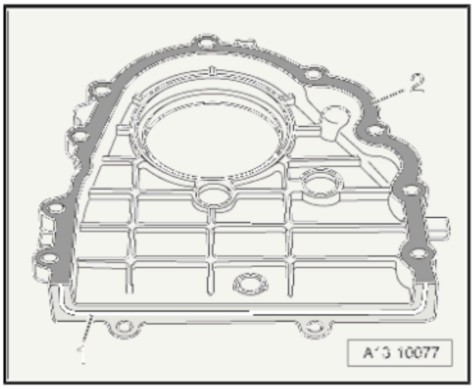


Timing chain cover (left-side)

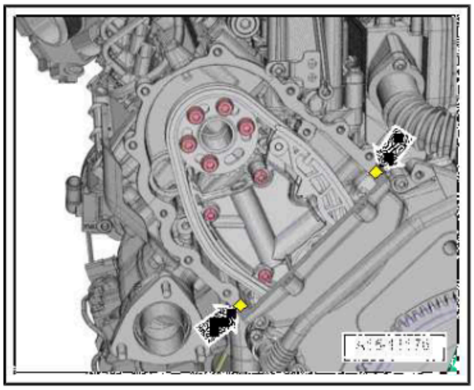
– Apply bead of sealant onto clean sealing surface of timing chain cover (left-side) as illustrated.

- The groove -1- on the sealing surface must be completely filled with sealant.
- The bead of sealant must project 1.5 … 2.0 mm above the sealing surface.

– Fit gasket -2-.



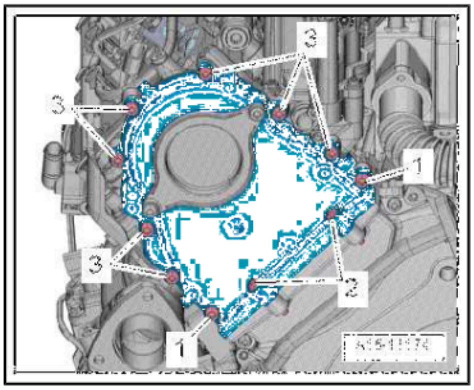
– Apply a bead of sealant (∅ 3 mm) at each joint between cylinder head and timing chain cover (bottom) -arrow-, as shown in illustration.



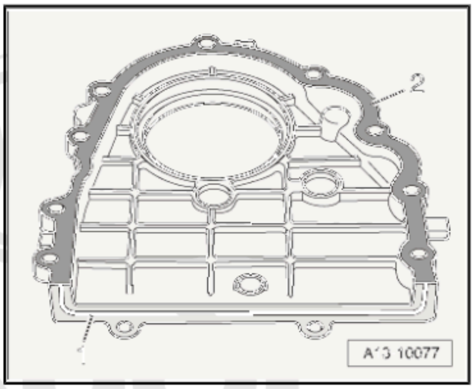
> ⚠ Caution
>
> *Make sure lubrication system is not clogged by excess sealant.*
>
> ◆ *The sealant bead must not be thicker than specified.*

– Fit timing chain cover (left-side) and tighten bolts as follows:

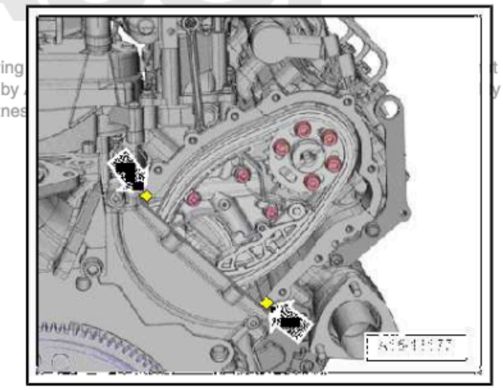
Stage	Bolts	Tightening torque
1.	-1-	3 Nm
2.	-2-	9 Nm
3.	-1-	9 Nm
4.	-3-	9 Nm in diagonal sequence



Timing chain cover (right-side)



- Apply bead of sealant onto clean sealing surfaces of timing chain cover (right-side) as illustrated.
- The groove -1- on the sealing surface must be completely filled with sealant.
- The bead of sealant must project 1.5 … 2.0 mm above the sealing surface.
- Fit gasket -2-.

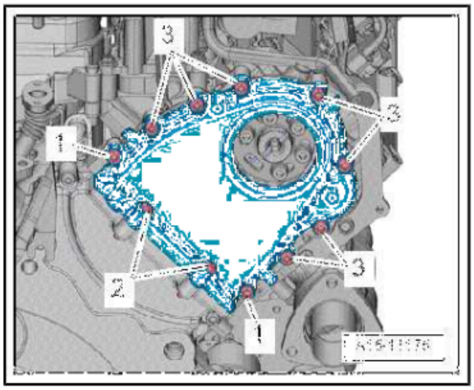


- Apply a bead of sealant (∅ 3 mm) at each joint between cylinder head and timing chain cover (bottom) -arrow-, as shown in illustration.

Caution

Make sure lubrication system is not clogged by excess sealant.

- ♦ *The sealant bead must not be thicker than specified.*



- Fit timing chain cover (right) and tighten bolts as follows:

Stage	Bolts	Tightening torque
1.	-1-	3 Nm
2.	-2-	9 Nm
3.	-1-	9 Nm
4.	-3-	9 Nm in diagonal sequence

Remaining installation steps are carried out in reverse sequence; note the following:

- Install vacuum pump ⇒ page 64 .
- Install turbocharger ⇒ page 243 .
- Install intermediate pipe: left-side ⇒ page 292 , right-side ⇒ page 294 .
- Install coolant pipe (rear) ⇒ page 228 .
- Install crankshaft oil seal (timing chain end) ⇒ page 67 .
- Install drive plate ⇒ page 66 .
- Bolt gearbox to engine and install engine/gearbox assembly ⇒ page 36 .
- Fill up with engine oil and check oil level ⇒ page 200 .

Tightening torques

Component		Nm
Timing chain cover (bottom) to engine	M6	9
	M8	23

2.8 Camshaft timing chains - exploded view

Camshaft timing chain (left-side)

1 - 5 Nm + 90° ($^1/_4$ turn) further
  - ☐ Renew

2 - Thrust washer for drive sprocket

3 - Drive sprocket for timing chain (left-side)

4 - 5 Nm + 90° ($^1/_4$ turn) further
  - ☐ Renew

5 - Chain tensioner for timing chain (left-side)

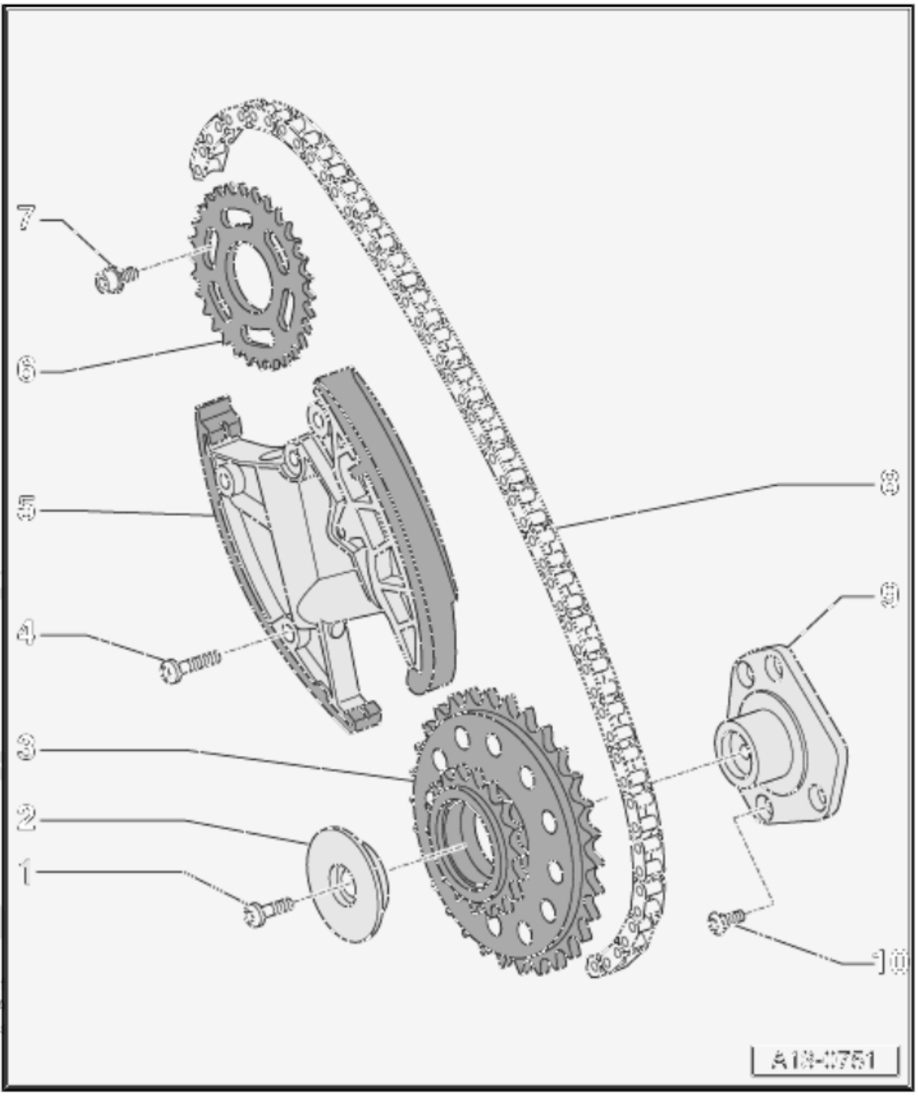
6 - Chain sprocket for inlet camshaft
  - ☐ Side with lettering faces towards gearbox

7 - 23 Nm

8 - Timing chain (left-side)
  - ☐ Before removing, mark running direction with paint

9 - Bearing bracket for drive sprocket

10 - 9 Nm



Camshaft timing chain (right-side)

1 - 45 Nm

2 - Bearing mounting for drive sprocket

3 - Timing chain (right-side)

- ☐ Before removing, mark running direction with paint

4 - Chain sprocket for inlet camshaft

- ☐ Side with lettering faces towards gearbox

5 - 23 Nm

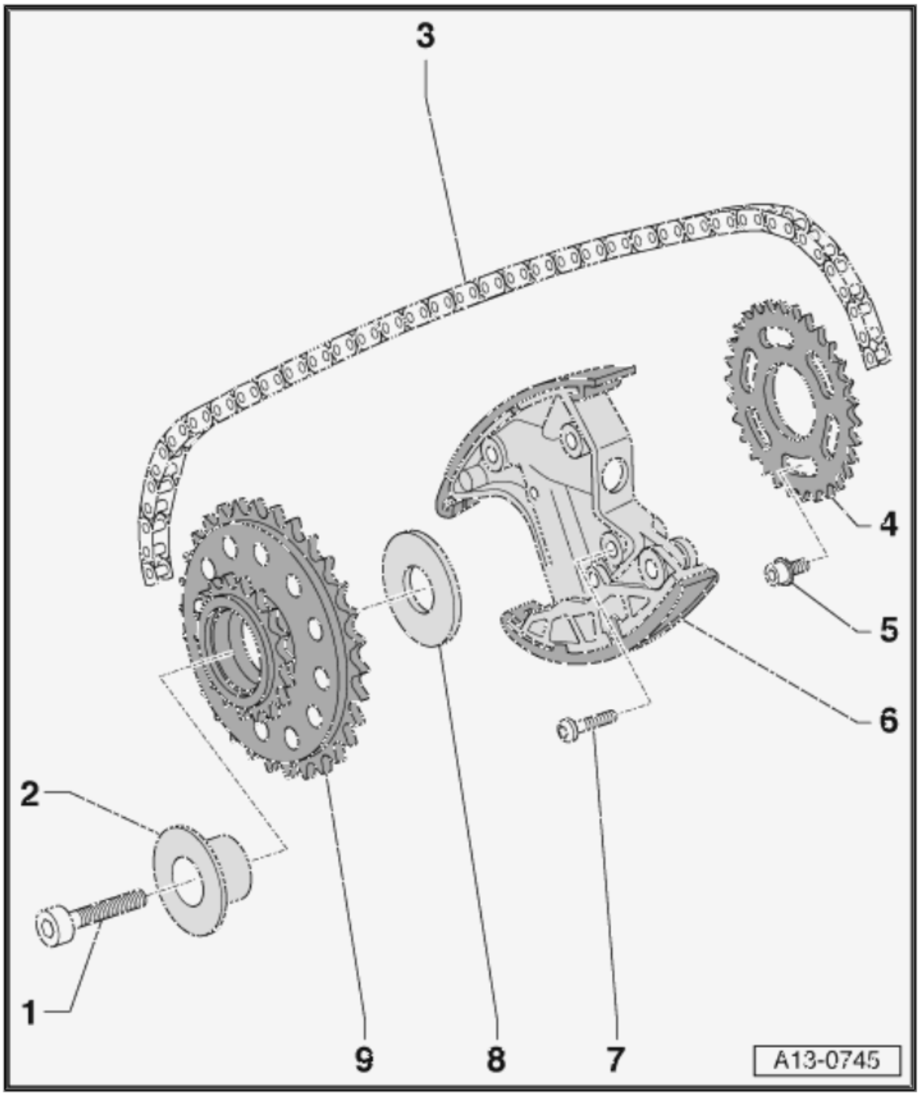
6 - Chain tensioner for timing chain (right-side)

7 - 5 Nm + 90° (${}^{1}/_{4}$ turn) further

- ☐ Renew

8 - Thrust washer for drive sprocket

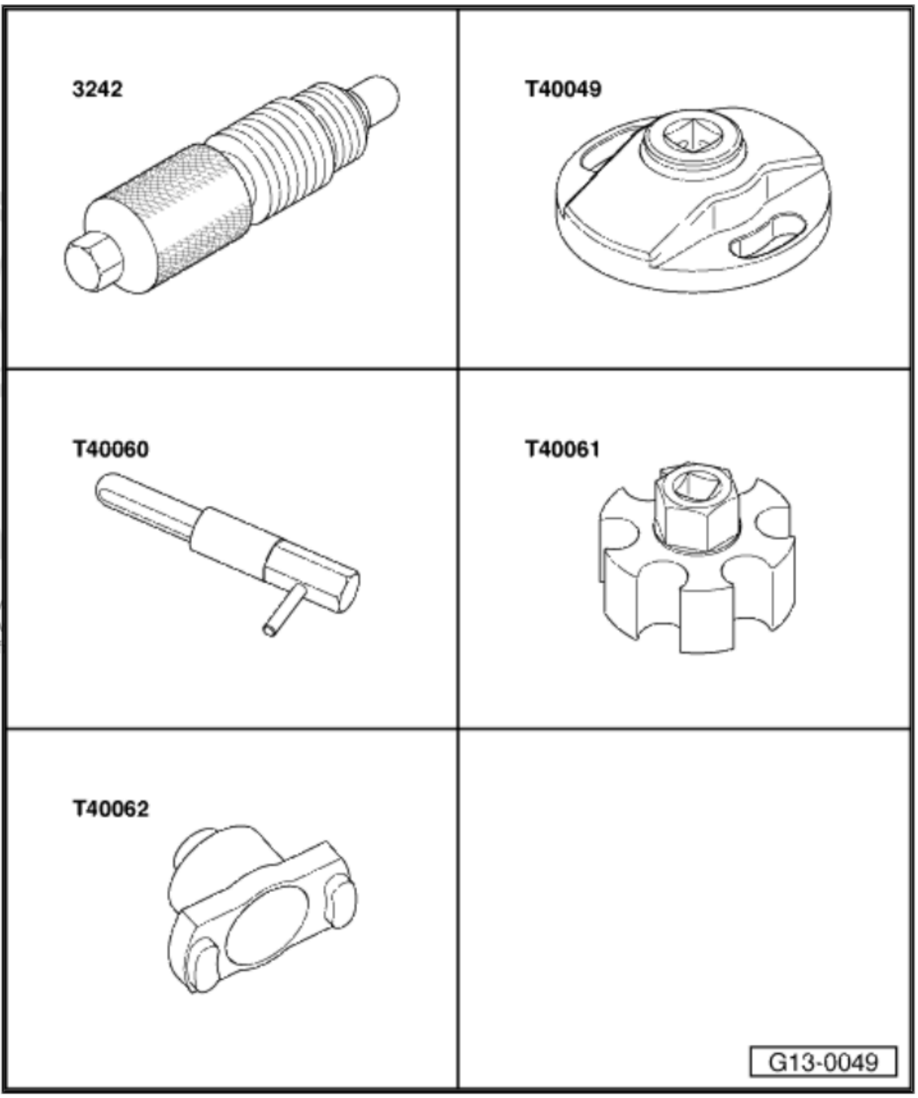
9 - Drive sprocket for timing chain (right-side)



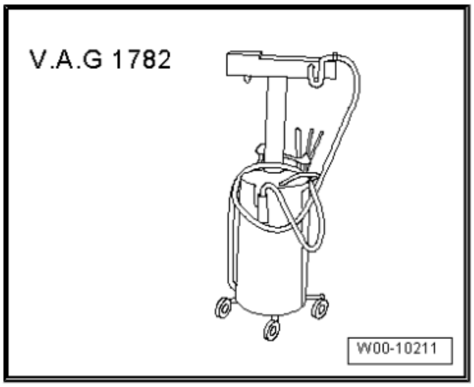
2.9 Removing and installing camshaft timing chains

Special tools and workshop equipment required

- Locking pin -3242-
- Special wrench -T40049-
- 2x Adjustment pin -T40060-
- Adapter -T40061-
- Adapter -T40062-



- Used oil collection and extraction unit -V.A.G 1782-



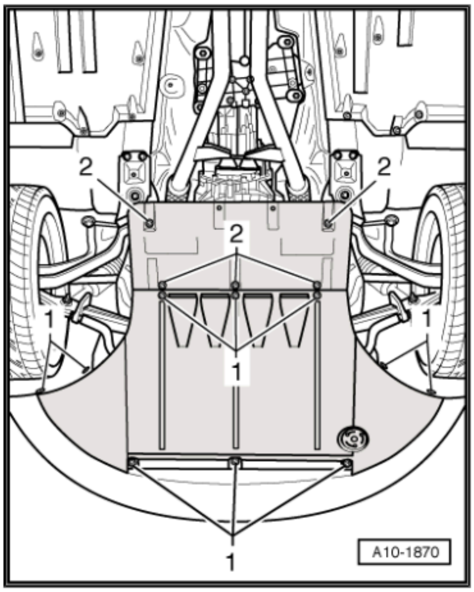
- Drill bit 3.3 mm ∅ (2x)

Removing

Caution

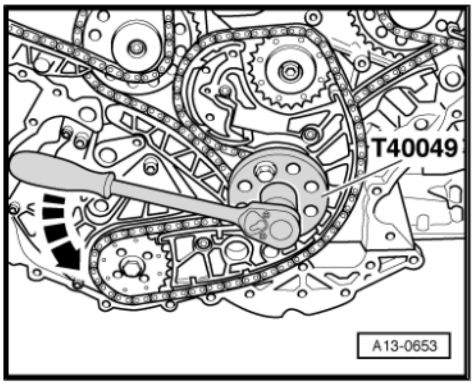
The crankshaft and camshafts must only be turned with the chain drive mechanism fully installed. Otherwise the valves may strike the pistons, causing damage to valves and piston crowns.

- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.

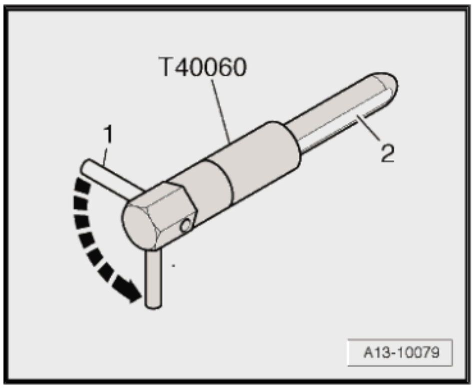


- Place used oil collection and extraction unit -V.A.G 1782- under engine.
- Drain off engine oil.
- Remove engine ⇒ page 8 .

- Separate engine from gearbox ⇒ page 27 .
- Secure engine to engine and gearbox support ⇒ page 34 , or leave engine on scissor-type assembly platform -VAS 6131 A- .
- Remove drive plate ⇒ page 66 .
- Remove timing chain covers ⇒ page 71 .



- Attach special wrench -T40049- at rear end of crankshaft using two old securing bolts for drive plate.



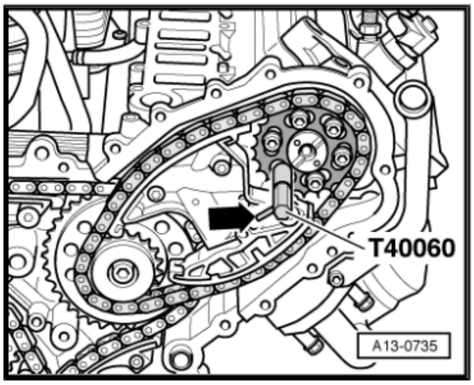
Note

- *The adjustment pin -T40060- has a flat -2- which makes it easier to insert when the locating bores in the camshaft and cylinder head are not exactly in line.*
- *The adjustment pin is inserted initially so that the side pin -1- is perpendicular to the imaginary line between the adjustment pin and the centre of the camshaft.*
- *To obtain the correct TDC position, the side pin -1- must then be turned 90° -arrow- so it is in line with the imaginary line between the adjustment pin and the centre of the camshaft.*

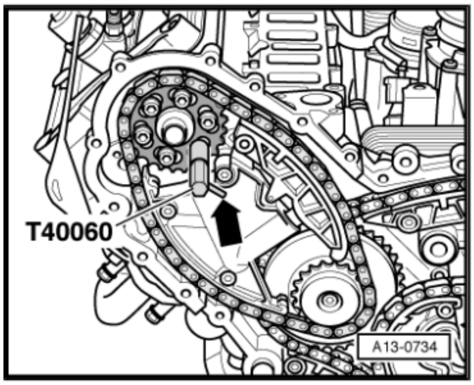
– Turn crankshaft in normal direction of rotation to TDC position:

- It should be possible to lock camshafts with adjustment pin -T40060- .
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

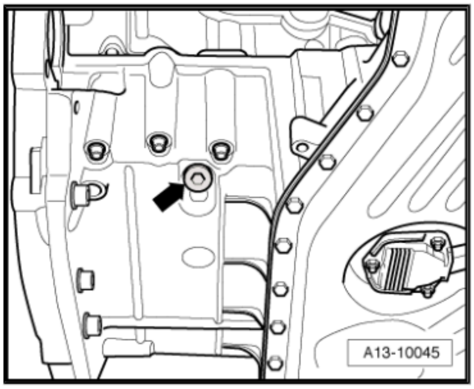
Cylinder bank 1 (right-side):



Cylinder bank 2 (left-side):



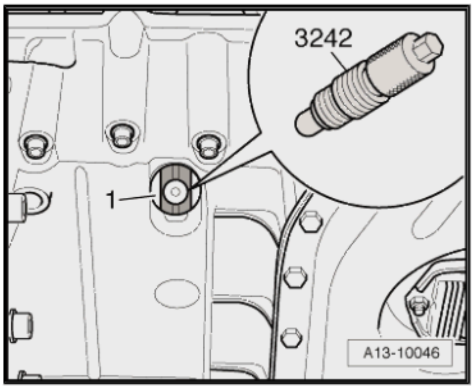
– Unscrew plug -arrow- from sump (top section).



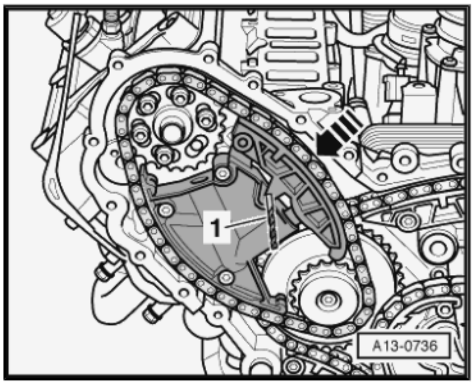
WARNING

To avoid any risk of injury, do not rotate the crankshaft while feeling for the TDC hole with your finger.

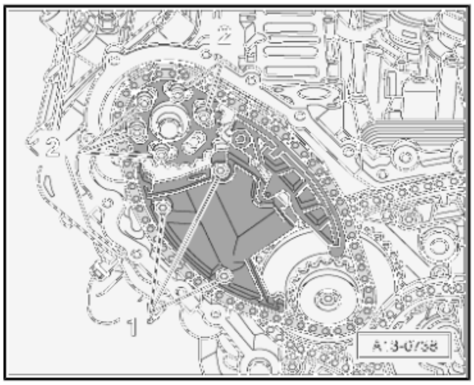
– Screw locking pin -3242- into bore (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.



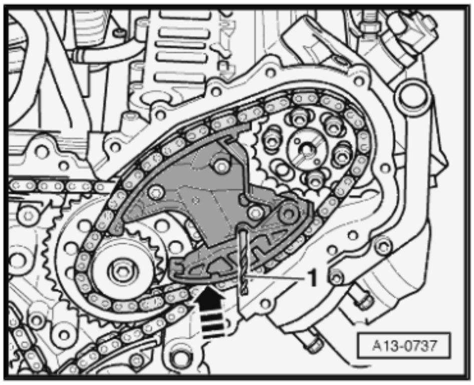
- Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
- Press guide rail of chain tensioner for timing chain (left-side) in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.
- Mark running direction of timing chain (left-side) with paint.
- Remove adjustment pin -T40060- from both camshafts.



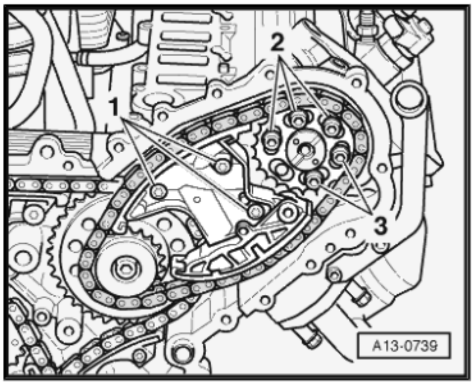
- Unscrew bolts -1- from chain tensioner and -2- from camshaft sprocket.
- Take off camshaft sprocket, chain tensioner and timing chain (left-side).



- Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
- Press guide rail of chain tensioner for timing chain (right-side) in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.
- Mark running direction of timing chain (right-side) with paint.

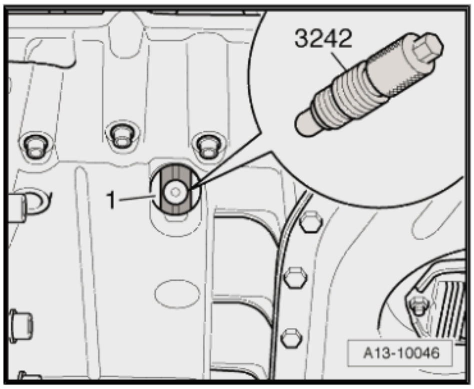


- Unscrew bolts -1- from chain tensioner and -2- from camshaft sprocket.
- Take off camshaft sprocket, chain tensioner and timing chain (right-side).



Installing

- Crankshaft -1- locked in TDC position with locking pin -3242- .
- Drive chain for valve gear installed ⇒ page 99



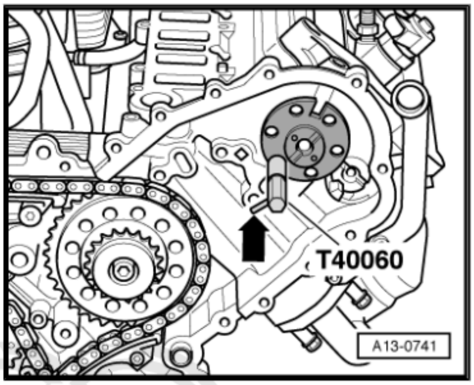
Note

◆ *Renew seal.*

◆ *Renew the bolts tightened with specified tightening angle.*

Caution

The crankshaft must not be at TDC at any cylinder when the camshafts are turned. Otherwise, there is a risk of damage to valves and piston crowns.

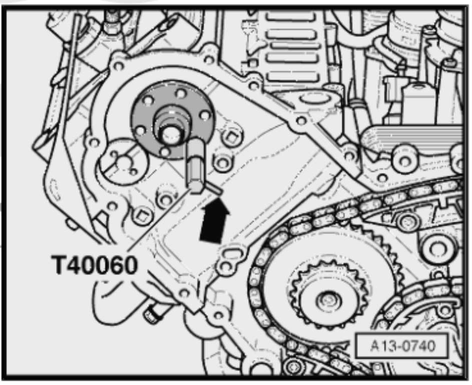


– Check that camshafts on both cylinder heads are positioned at TDC.

- It should be possible to lock camshafts with adjustment pin -T40060- .
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):

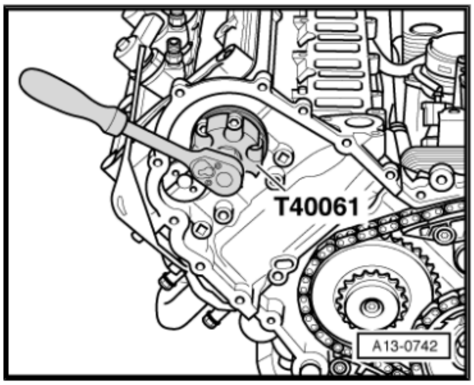
Cylinder bank 2 (left-side):



– Remove adjustment pin -T40060- from both camshafts.

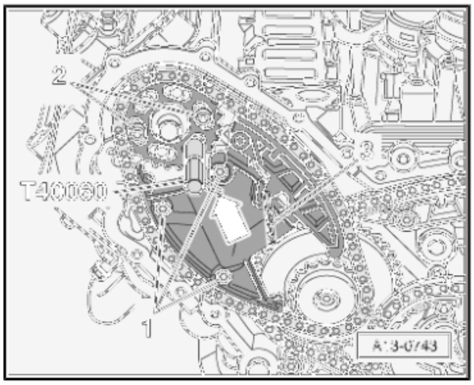
Note

If the adjustment pins cannot be inserted in the camshafts, the camshafts can be turned slightly using adapter -T40061- . To do so, screw securing bolts for camshaft sprocket into camshaft.

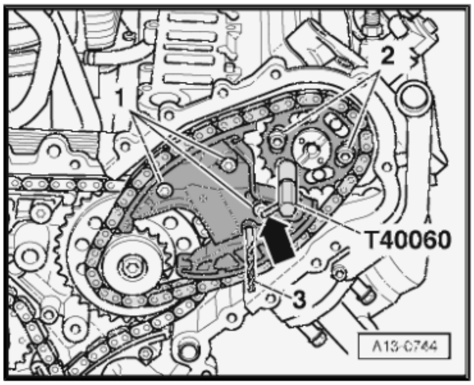


Caution

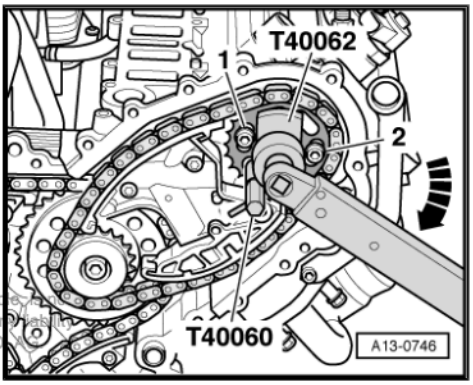
The crankshaft must not be at TDC at any cylinder when the camshafts are turned. Otherwise there is a risk of damage to valves and piston crowns.



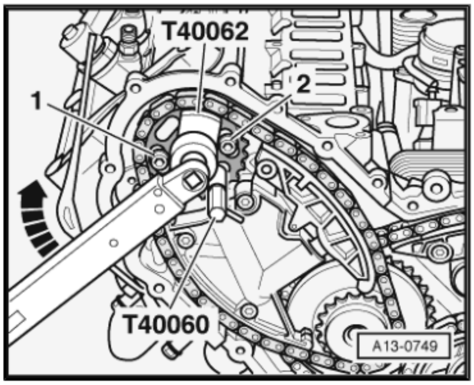
- Install timing chain (left-side) with camshaft sprocket and chain tensioner.
- The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.
- Tighten bolts -1- for chain tensioner.
- Screw in two bolts -2- for sprocket, but do not tighten bolts.
- It should just be possible to turn the sprocket on the camshaft without axial movement.
- Lock camshaft (left-side) with adjustment pin -T40060- .
- The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.
- Pull drill bit -3- from locating hole, this releases the chain tensioner (left-side).



- Install timing chain (right-side) with camshaft sprocket and chain tensioner.
- The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.
- Tighten bolts -1- for chain tensioner.
- Screw in two bolts -2- for sprocket, but do not tighten bolts.
- It should just be possible to turn the sprocket on the camshaft without axial movement.
- Lock camshaft (right-side) with adjustment pin -T40060- .
- The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.
- Pull drill bit -3- out of locating hole; this releases the chain tensioner (right-side).

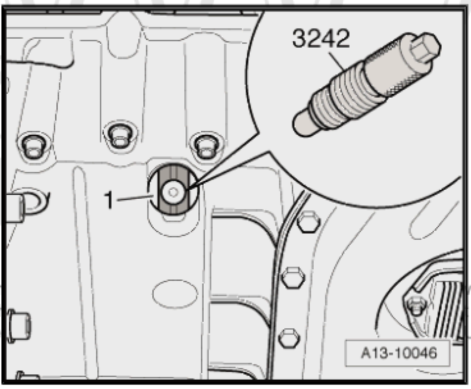


- Using a torque wrench and adapter -T40062- , apply a torque of 30 Nm to camshaft sprocket (right-side) in the direction indicated (-arrow-). Maintain this torque for the following step.
- Tighten bolts -1- and -2-.
- Take off adapter -T40062- and pull out adjustment pin -T40060- .
- Tighten remaining bolts for sprocket (right-side).



- Using a torque wrench and adapter -T40062- , apply a torque of 15 Nm to camshaft sprocket (left-side) in the direction indicated (-arrow-). Maintain this torque for the following step.
- Tighten bolts -1- and -2-.
- Take off adapter -T40062- and pull out adjustment pin -T40060- .
- Tighten remaining bolts for sprocket (left-side).

- Remove locking pin -3242- .



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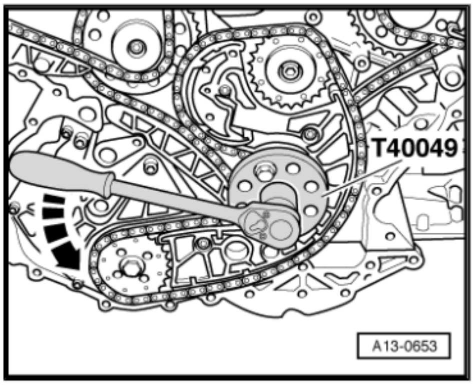
Checking valve timing

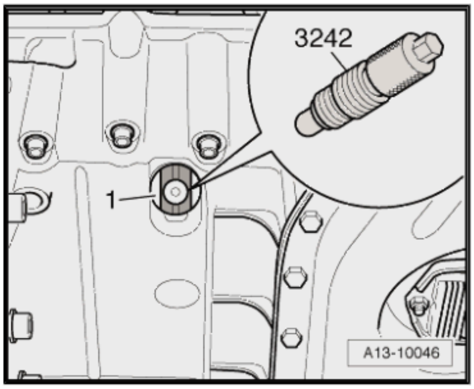
> **Caution**
>
> *Do not rotate crankshaft in opposite direction of engine rotation.*

- Using special wrench -T40049- , turn crankshaft two rotations in normal direction of rotation -arrow- until crankshaft is just before TDC again.



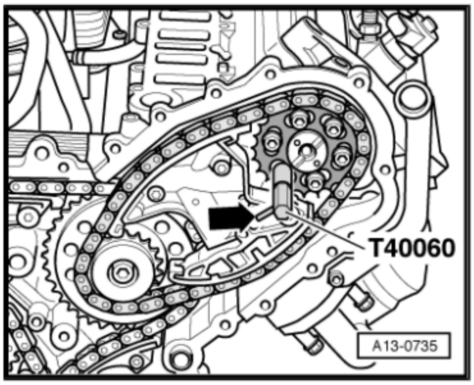
- While turning in this direction, lock crankshaft -1- with locking pin -3242- . Tighten locking pin to 20 Nm.

> **Caution**
>
> *If the crankshaft has been rotated even only slightly beyond the TDC position, turn it back approx. 10° so you can then reset it to TDC by turning in the normal direction of rotation.*

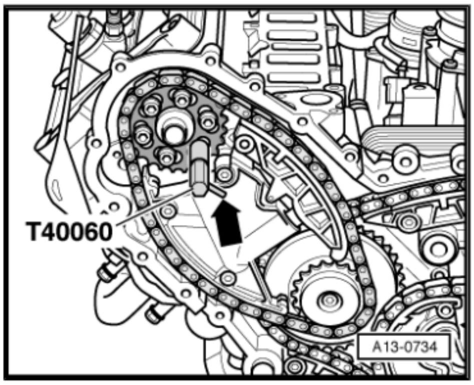


- Check that it is now possible to lock the camshafts with adjustment pin -T40060- .
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):



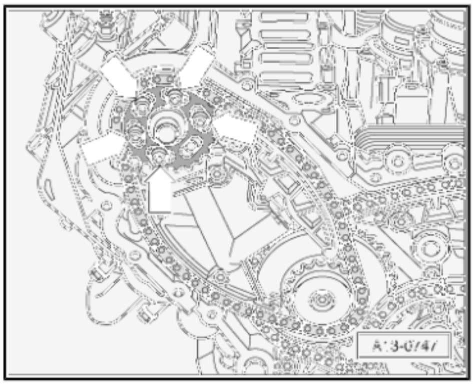
Cylinder bank 2 (left-side):

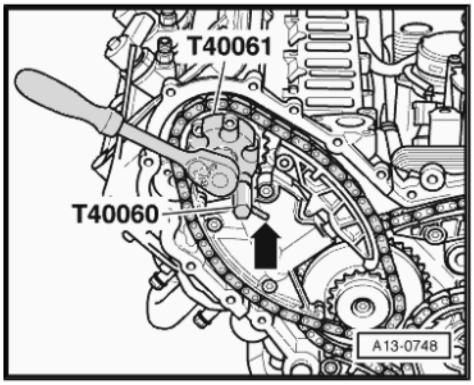


Adjusting valve timing

If the adjustment pin cannot be inserted in one of the camshafts:

– Loosen all bolts -arrows- on the relevant sprocket approx. 1 turn.





– Apply adapter -T40061- to the heads of the loosened bolts.

– Turn camshaft slightly backwards and forwards with adapter -T40061- until adjustment pin -T40060- can be inserted.

- The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

– With adapter -T40061- and adjustment pin -T40060- still in position, tighten bolts on sprocket to approx: 5 Nm.

– Remove adjustment pin -T40060- and adapter -T40061- .

– Tighten bolts on sprocket to final torque.

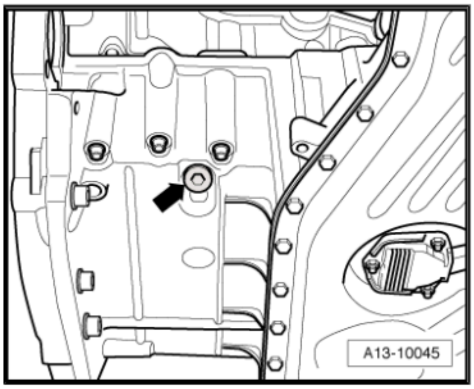
– Repeat this procedure on the other cylinder bank if necessary.

– Remove locking pin -3242- .

– Check valve timing once again ⇒ page 86 .

Remaining installation steps are carried out in reverse sequence; note the following:

- Screw plug -arrow- for TDC mark into top section of sump with a new seal.
- Install timing chain covers ⇒ page 74 .
- Install drive plate ⇒ page 66 .
- Bolt gearbox to engine and install engine/gearbox assembly ⇒ page 36 .
- Fill up with engine oil and check oil level ⇒ page 200 .



Tightening torques

Component	Nm
Chain tensioner to cylinder head	5 + 90° 1)2)
Camshaft sprocket to camshaft	23
Screw plug in top section of sump	35

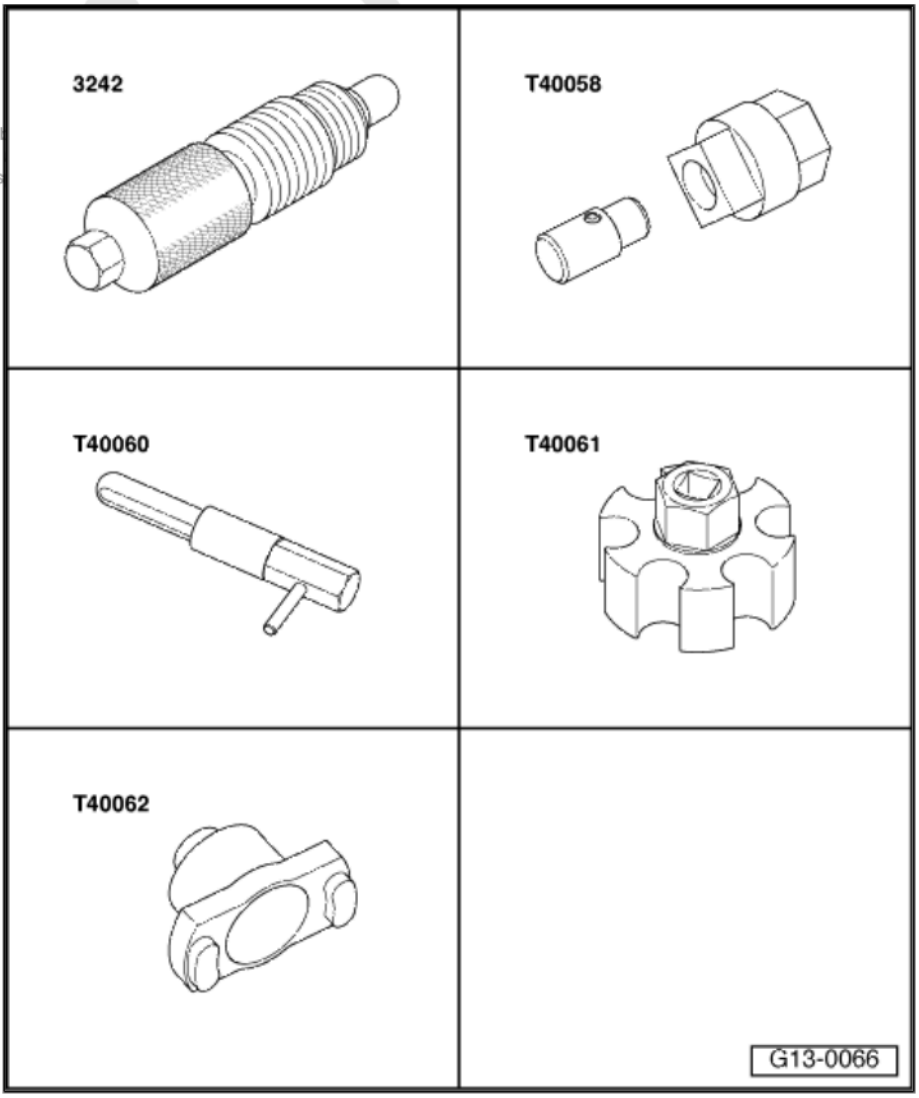
- 1) Renew bolts.
- 2) 90° = a quarter of a turn.

2.10 Detaching camshaft timing chains from camshafts

Special tools and workshop equipment required

- ◆ Locking pin -3242-
- ◆ Adapter -T40058-
- ◆ 2x Adjustment pin -T40060-
- ◆ Adapter -T40061-
- ◆ Adapter -T40062-
- ◆ Drill bit 3.3 mm ∅ (2x)

Protected
permitted



Note

- *When working on one cylinder head only, it is not necessary to remove the timing chain cover on the opposite cylinder head as well. In this case it is only necessary to remove the vacuum pump or the sealing cap, because the timing chain on this cylinder head stays in place.*
- *However, the valve timing for both cylinder heads must be adjusted in all cases as described below.*

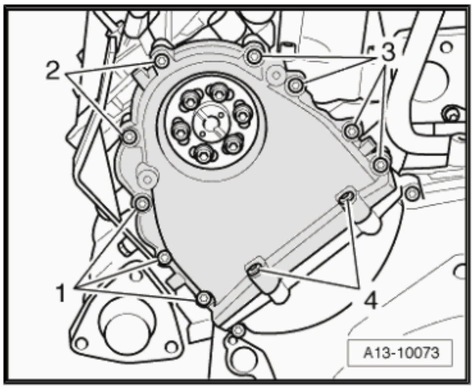
Removing

- Engine in vehicle.

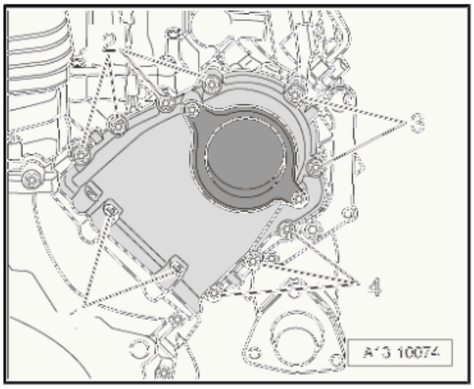
Note

For illustration purposes, the following work on the timing chains is shown from the rear with the engine removed

- Drain off coolant ⇒ page 202 .
- Move lock carrier to service position ⇒ page 43 .
- Remove vacuum pump ⇒ page 64 .
- Remove coolant pipe (rear) ⇒ page 228 .
- Remove bolts -1 ... 4- and detach timing chain cover (left-side).

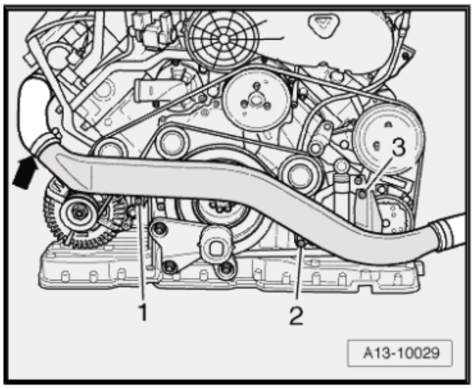


- Remove bolts -1 ... 4- and detach timing chain cover (right-side).

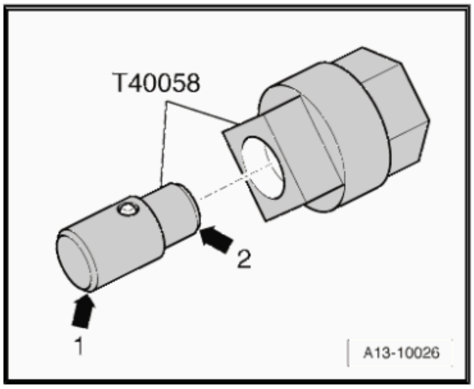


– Disconnect air intake hose -arrow- from air pipe (top).

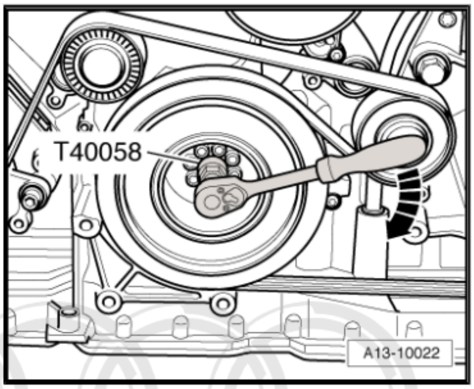
– Unscrew bolts -1 ... 3- and detach air pipe (top).



– Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.

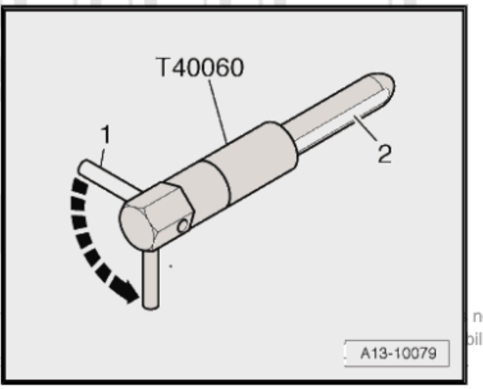


– Using adapter -T40058- turn the crankshaft in the normal direction of rotation -arrow- to TDC.



Note

- *The adjustment pin -T40060- has a flat -2- which makes it easier to insert when the locating bores in the camshaft and cylinder head are not exactly in line.*
- *The adjustment pin is inserted initially so that the side pin -1- is perpendicular to the imaginary line between the adjustment pin and the centre of the camshaft.*
- *To obtain the correct TDC position, the side pin -1- must then be turned 90° -arrow- so it is in line with the imaginary line between the adjustment pin and the centre of the camshaft.*



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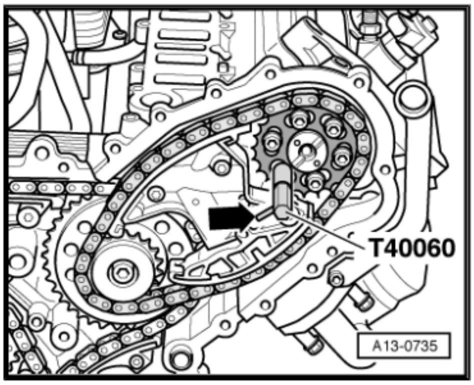
with respect to the correct

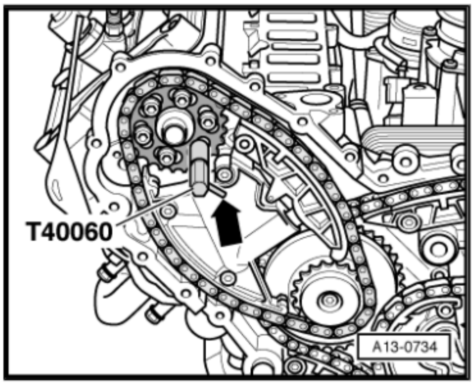
- Check that camshafts on both cylinder heads are positioned at TDC.

- It should be possible to lock camshafts with adjustment pin -T40060- .
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

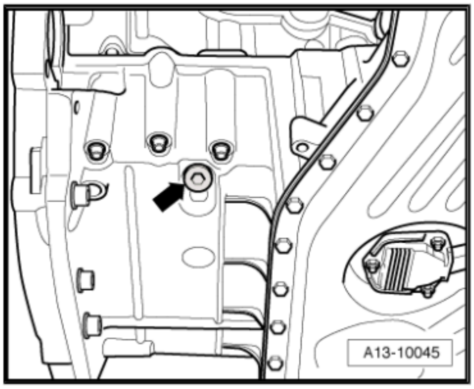
Cylinder bank 1 (right-side):



Cylinder bank 2 (left-side):

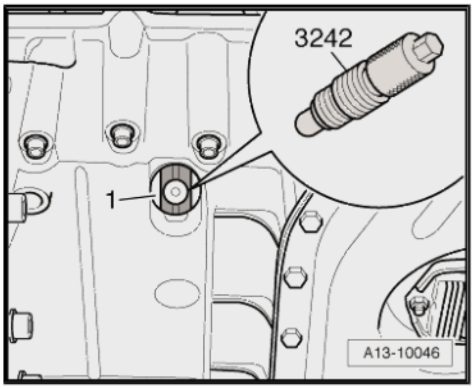


- Lay a cloth beneath sump (top section) to catch engine oil.
- Unscrew plug -arrow- from sump (top section).

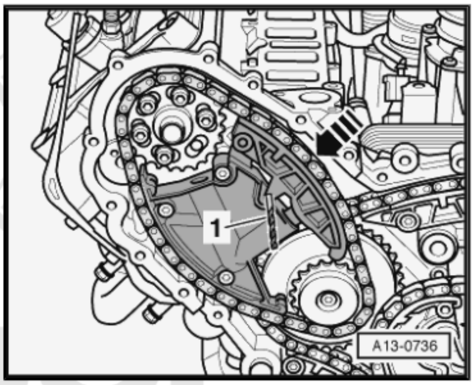


> **WARNING**
>
> *To avoid any risk of injury, do not rotate the crankshaft while feeling for the TDC hole with your finger.*

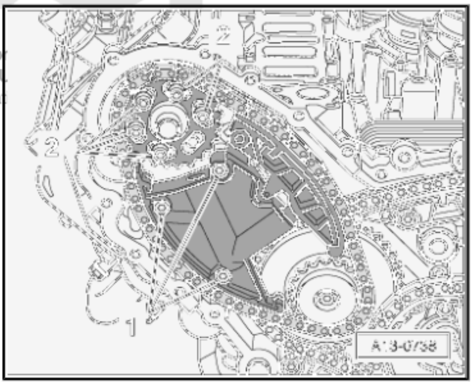
- Screw locking pin -3242- into bore (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.



- Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
- Press guide rail of chain tensioner for timing chain (left-side) in direction of arrow and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.



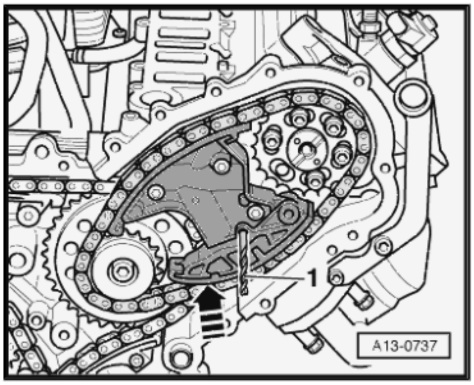
- Unscrew bolts -1- from chain tensioner and -2- from camshaft sprocket.
- Remove camshaft sprocket and chain tensioner (left-side).



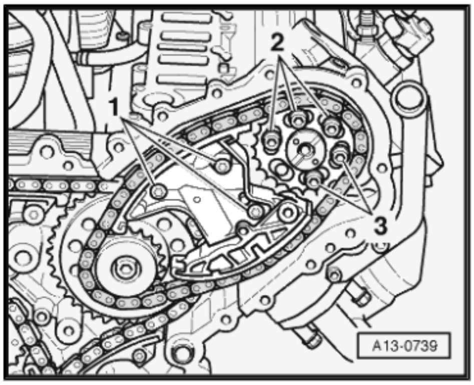
Note

Cover chain tensioner opening with a cloth or similar to stop small parts dropping in.

- Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
- Press guide rail of chain tensioner for timing chain (right-side) in direction of arrow and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.



- Unscrew bolts -1- from chain tensioner and -2- from camshaft sprocket.
- Remove camshaft sprocket and chain tensioner (right-side).

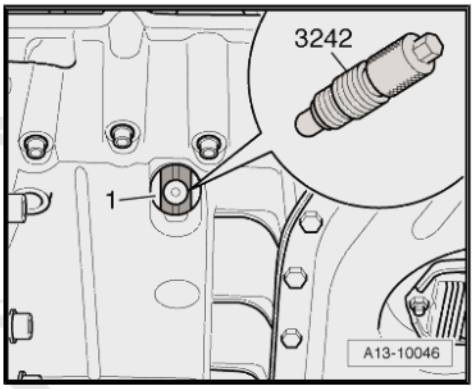


Note

Cover chain tensioner opening with a cloth or similar to stop small parts dropping in.

Installing

- Crankshaft -1- locked in TDC position with locking pin -3242- .

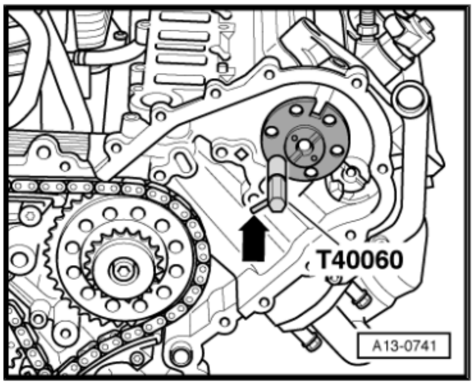


Note

- ◆ *Renew gaskets, seals and O-rings.*
- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ◆ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- ◆ *The crankshaft must not be at TDC at any cylinder when the camshaft is turned. Otherwise, there is a risk of damage to valves and piston crowns.*

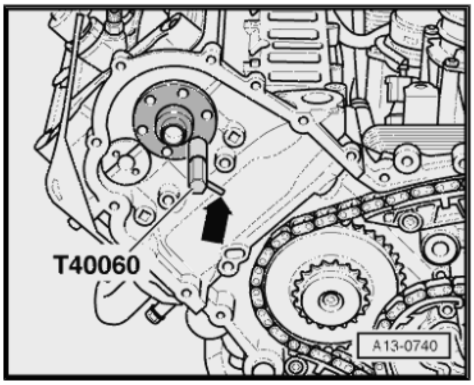
- – Check that camshafts on both cylinder heads are positioned at TDC.
- It should be possible to lock camshafts with adjustment pin -T40060- .
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):



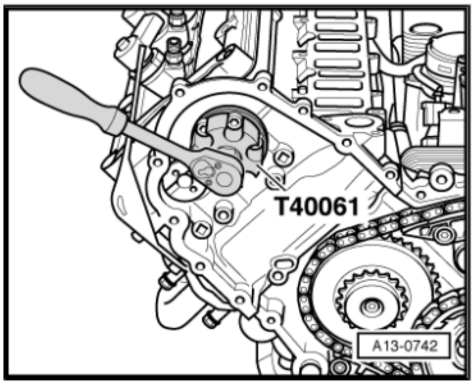
Cylinder bank 2 (left-side):

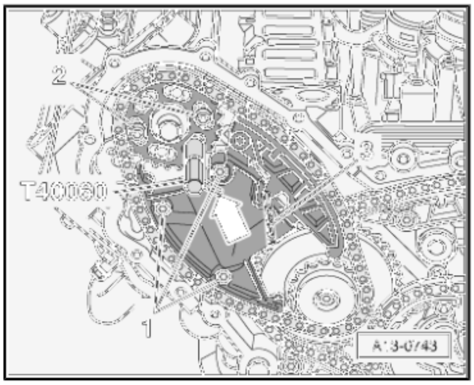
- – Remove adjustment pin -T40060- from both camshafts.



Note

- ◆ *If the adjustment pins cannot be inserted in the camshafts, the camshafts can be turned slightly using adapter -T40061- . To do so, screw securing bolts for camshaft sprocket into camshaft.*
- ◆ *The crankshaft must not be at TDC at any cylinder when the camshaft is turned. Otherwise, there is a risk of damage to valves and piston crowns.*





– Install timing chain (left-side) with camshaft sprocket and chain tensioner.

- The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.

– Tighten bolts -1- for chain tensioner.

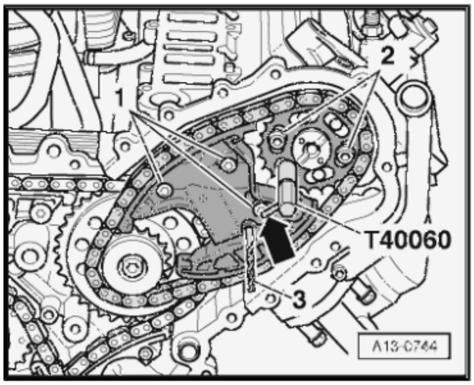
– Screw in two bolts -2- for sprocket, but do not tighten bolts.

- It should just be possible to turn the sprocket on the camshaft without axial movement.

– Lock camshaft (left-side) with adjustment pin -T40060- .

- The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

– Pull drill bit -3- from locating hole, this releases the chain tensioner (left-side).



– Install timing chain (right-side) with camshaft sprocket and chain tensioner.

- The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.

– Tighten bolts -1- for chain tensioner.

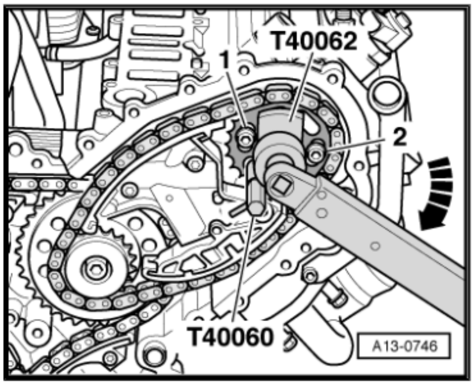
– Screw in two bolts -2- for sprocket, but do not tighten bolts.

- It should just be possible to turn the sprocket on the camshaft without axial movement.

– Lock camshaft (right-side) with adjustment pin -T40060- .

- The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

– Pull drill bit -3- out of locating hole; this releases the chain tensioner (right-side).

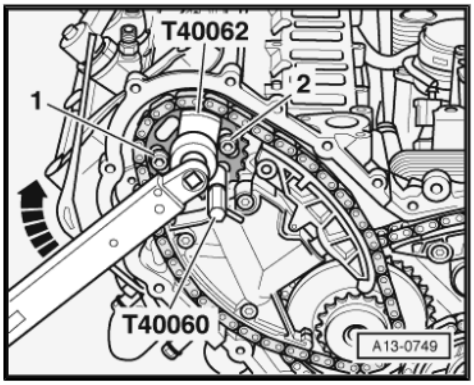


– Apply a torque of 30 Nm to camshaft sprocket (right-side) in direction of arrow using a torque wrench and adapter -T40062- . Maintain this torque for the following step.

– Tighten bolts -1- and -2-.

– Take off adapter -T40062- and pull out adjustment pin -T40060- .

– Tighten remaining bolts for sprocket (right-side).



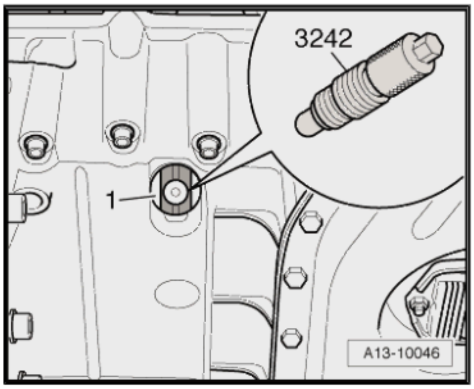
– Using a torque wrench and adapter -T40062- , apply a torque of 15 Nm to camshaft sprocket (left-side) in the direction indicated (-arrow-). Maintain this torque for the following step.

– Tighten bolts -1- and -2-.

– Take off adapter -T40062- and pull out adjustment pin -T40060- .

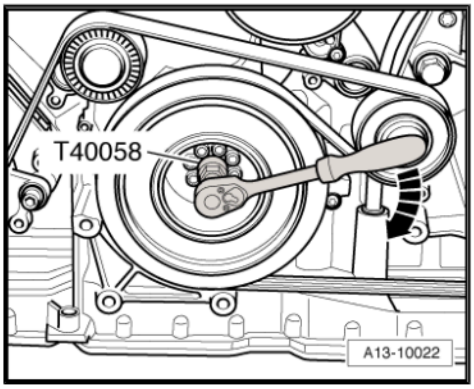
– Tighten remaining bolts for sprocket (left-side).

– Remove locking pin -3242- .



Checking valve timing

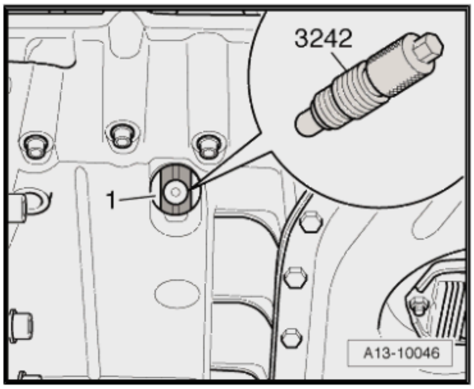
– Turn crankshaft two rotations in normal direction of rotation -arrow- until the crankshaft is just before TDC again.



– While turning in this direction, lock crankshaft -1- with locking pin -3242- . Tighten locking pin to 20 Nm.

Caution

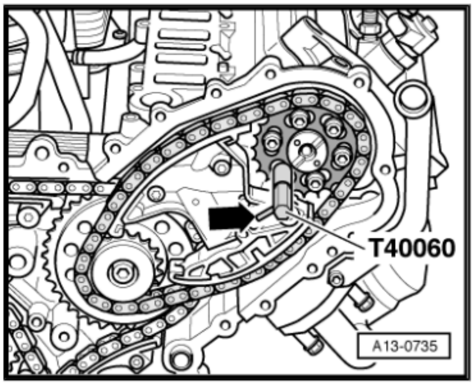
If the crankshaft has been rotated even only slightly beyond the TDC position, turn it back approx. 10° so you can then reset it to TDC by turning in the normal direction of rotation.



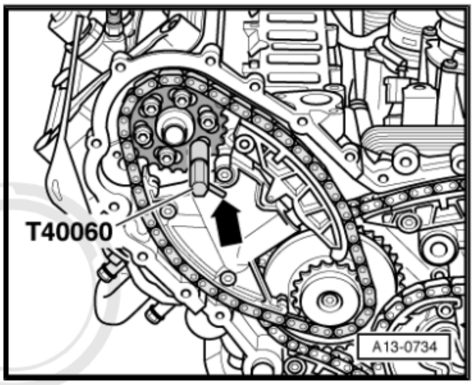
– Check that it is now possible to lock the camshafts with adjustment pin -T40060- .

- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):



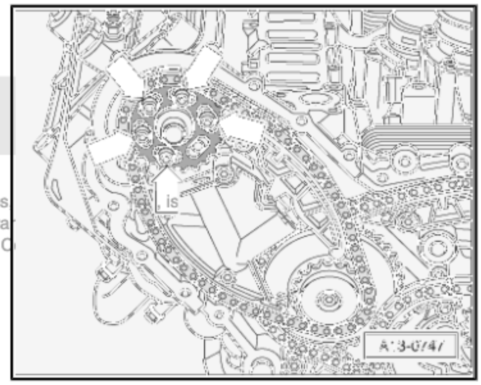
Cylinder bank 2 (left-side):



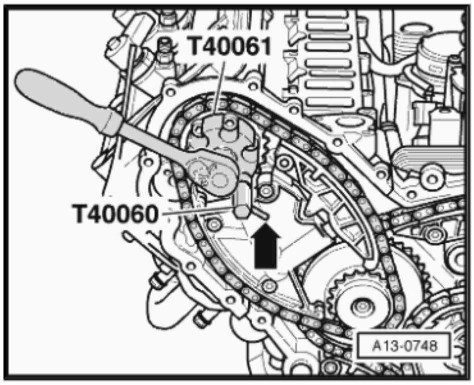
Adjusting valve timing

If the adjustment pin cannot be inserted in one of the camshafts:

- Loosen all bolts -arrows- on the relevant sprocket approx. 1 turn.

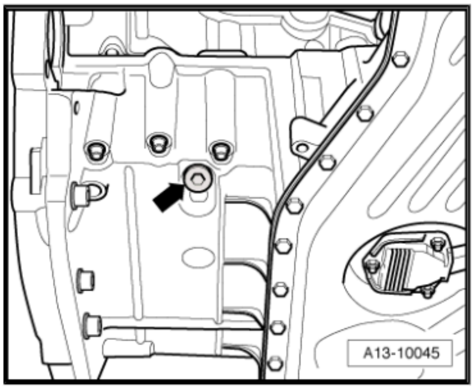


- Apply adapter -T40061- to the heads of the loosened bolts.
- Turn camshaft slightly backwards and forwards with adapter -T40061- until adjustment pin -T40060- can be inserted.
- The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.
- With adapter -T40061- and adjustment pin -T40060- still in position, tighten bolts on sprocket to approx: 5 Nm.
- Remove adjustment pin -T40060- and adapter -T40061- .
- Tighten bolts on sprocket to final torque.
- Repeat this procedure on the other cylinder bank if necessary.
- Remove locking pin -3242- .
- Check valve timing once again ⇒ page 95 .

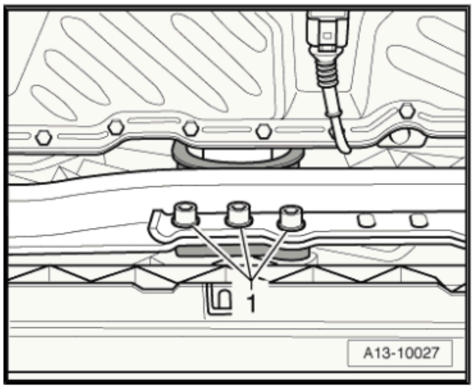


Remaining installation steps are carried out in reverse sequence; note the following:

- Screw plug -arrow- for TDC mark into top section of sump with a new seal.
- Install timing chain covers ⇒ page 74 .
- Install coolant pipe (rear) ⇒ page 228 .
- Install vacuum pump ⇒ page 64 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Fill cooling system ⇒ page 204 .

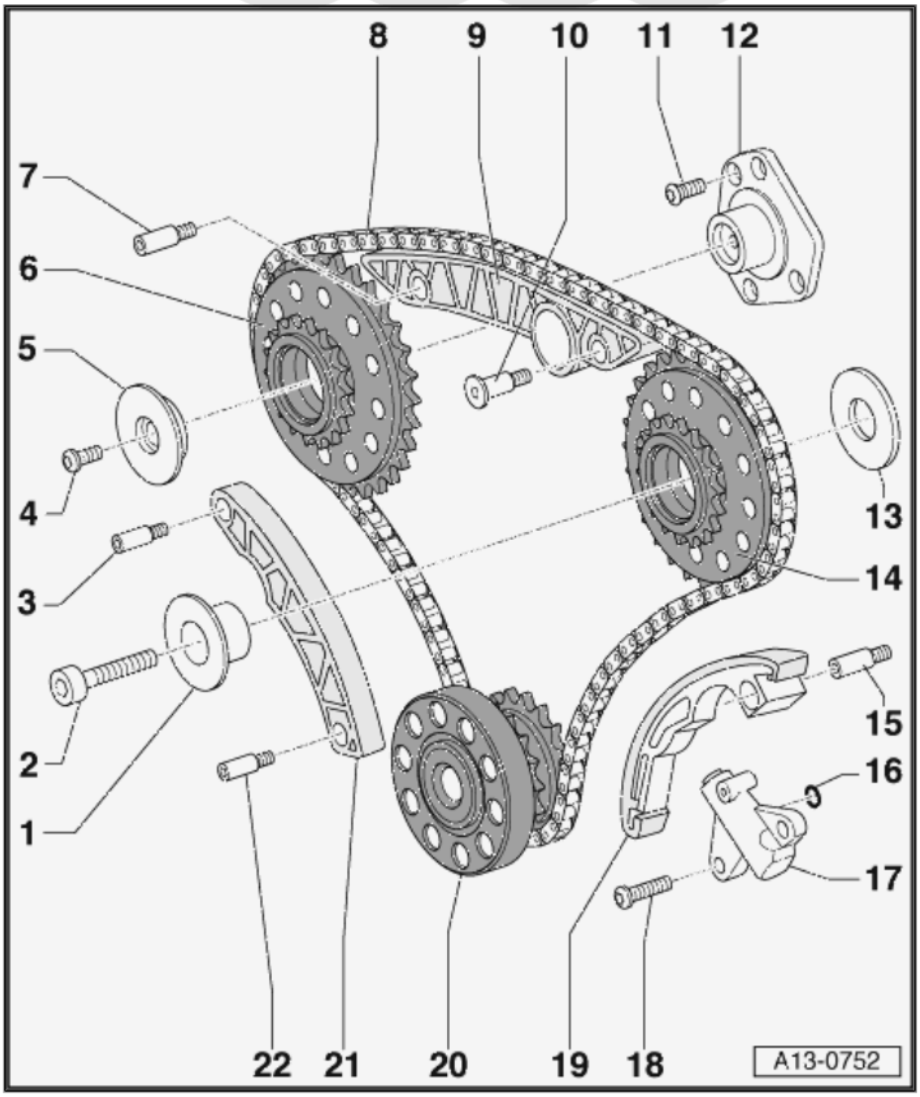


Tightening torques

Component		Nm
Chain tensioner to cylinder head		5 + 90° 1)2)
Camshaft sprocket to camshaft		23
Screw plug in top section of sump		35
Air pipe (top) to engine		9
Bracket for torque reaction support to cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

- 1) Renew bolts.
- 2) 90° = one quarter turn.

2.11 Drive chain for valve gear - exploded view



1 - Bearing mounting for drive sprocket

2 - 45 Nm

3 - Mounting pin, 12 Nm
- ☐ Heat with hot air blower when removing
- ☐ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

4 - 5 Nm + 90° ($^{1}/_{4}$ turn) further
- ☐ Renew

5 - Thrust washer for drive sprocket

6 - Drive sprocket for timing chain (left-side)

7 - Mounting pin, 12 Nm
- ☐ Heat with hot air blower when removing
- ☐ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

8 - Drive chain for valve gear
- ☐ Before removing, mark running direction with paint

9 - Guide rail

10 - Mounting pin, 12 Nm
- ☐ Heat with hot air blower when removing
- ☐ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

11 - 9 Nm

12 - Bearing bracket for drive sprocket

13 - Thrust washer

14 - Drive sprocket for timing chain (right-side)

15 - Mounting pin, 12 Nm
- ☐ Heat with hot air blower when removing
- ☐ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

16 - O-ring
- ☐ Renew

17 - Chain tensioner

18 - 12 Nm

19 - Guide rail for chain tensioner

20 - Crankshaft

21 - Guide rail
- ☐ Note installation position

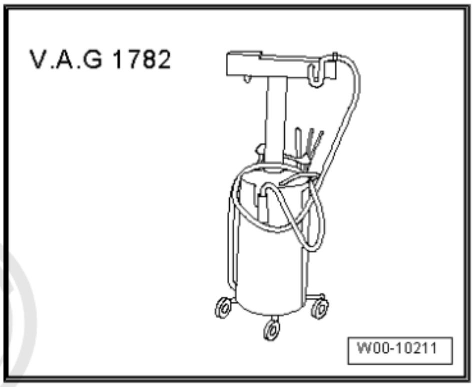
22 - Mounting pin, 9 Nm

- ❑ Heat with hot air blower when removing
- ❑ Install using locking fluid; for locking fluid refer to ⇒ Parts catalogue

2.12 Removing and installing drive chain for valve gear

Special tools and workshop equipment required

- ♦ Used oil collection and extraction unit -V.A.G 1782-

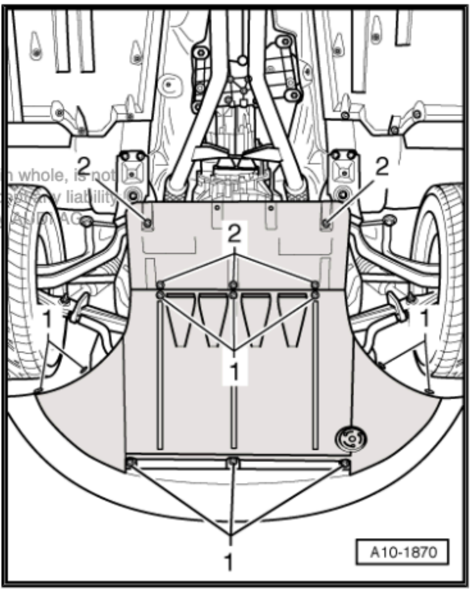


- ♦ Drill bit, ∅ 3.3 mm

Removing

Note

All cable ties which are released or cut open when removing must be refitted in the same position when installing.



– Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.

– Place used oil collection and extraction unit -V.A.G 1782- under engine.

– Drain off engine oil.

– Remove engine ⇒ page 8 .

– Separate engine from gearbox ⇒ page 27 .

– Secure engine to engine and gearbox support ⇒ page 34 , or leave engine on scissor-type assembly platform -VAS 6131 A- .

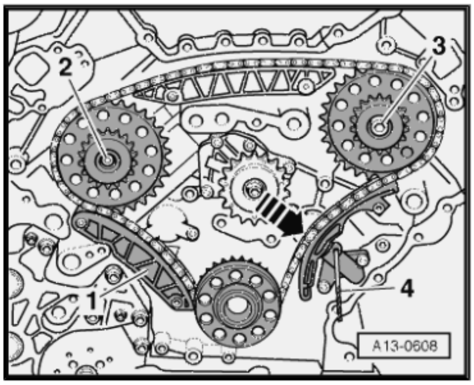
– Remove drive plate ⇒ page 66 .

– Remove timing chain covers ⇒ page 71 .

– Remove camshaft timing chains ⇒ page 80 .

– Remove chain for oil pump and balance shaft ⇒ page 102 .

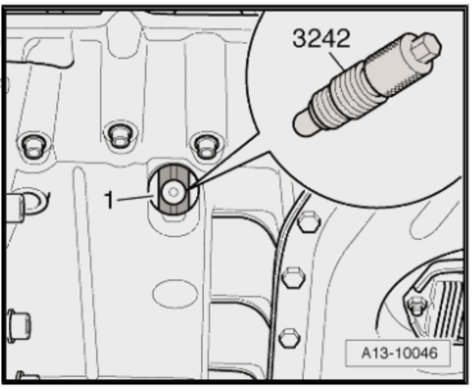
- Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
- Press guide rail of chain tensioner for drive chain in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 4-.
- Mark running direction of chain with paint.
- Remove bolts -2- and -3- and detach chain sprockets together with drive chain and guide rail -1-.



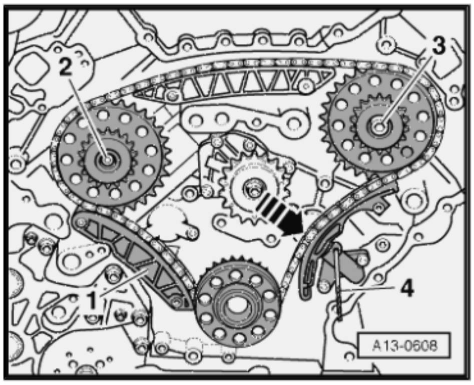
Installing

Installation is carried out in the reverse order, note the following:

- Crankshaft locked in TDC position with locking pin -3242- .



- First install sprocket for camshaft timing chain (left-side) -2-.
- Install guide rail -1- with drive chain fitted.
- Now install sprocket for camshaft timing chain (right-side) -3-.
- Press guide rail of drive chain tensioner in direction of -arrow- and pull drill bit -4- out of chain tensioner.
- Install chain for oil pump and balance shaft ⇒ page 102
- Install camshaft timing chains ⇒ page 84 .
- Install timing chain covers ⇒ page 74 .
- Install drive plate ⇒ page 66 .
- Bolt gearbox to engine and install engine/gearbox assembly ⇒ page 36 .
- Fill up with engine oil and check oil level ⇒ page 200 .



Tightening torques

Component	Nm
Drive chain sprocket (left-side) to bearing bracket	5 + 90° 1) 2)
Drive chain sprocket (right-side) to cylinder block	45

1) Renew bolts.

2) 90° = a quarter of a turn.

2.13 Drive chain for oil pump and balance shaft - exploded view

1 - 9 Nm

2 - Chain tensioner

- ☐ With guide rail

3 - Thrust washer

4 - Compression spring

5 - 23 Nm

6 - Chain sprocket for balance shaft

- ☐ Side with lettering faces towards gearbox

7 - Chain for oil pump and balance shaft

- ☐ Before removing, mark running direction with paint
- ☐ Removing and installing ⇒ page 102

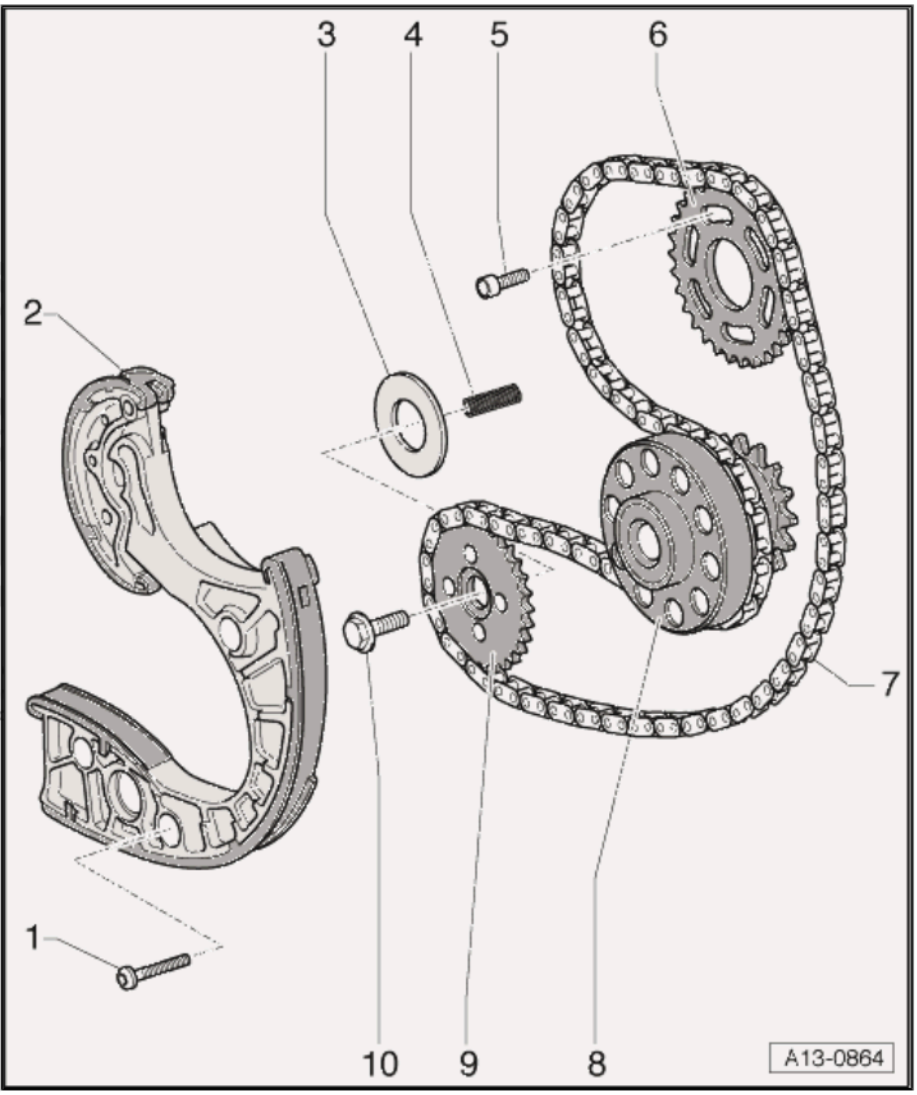
8 - Crankshaft

9 - Chain sprocket for oil pump

- ☐ Installation position: Side with lettering faces engine

10 - 62 Nm

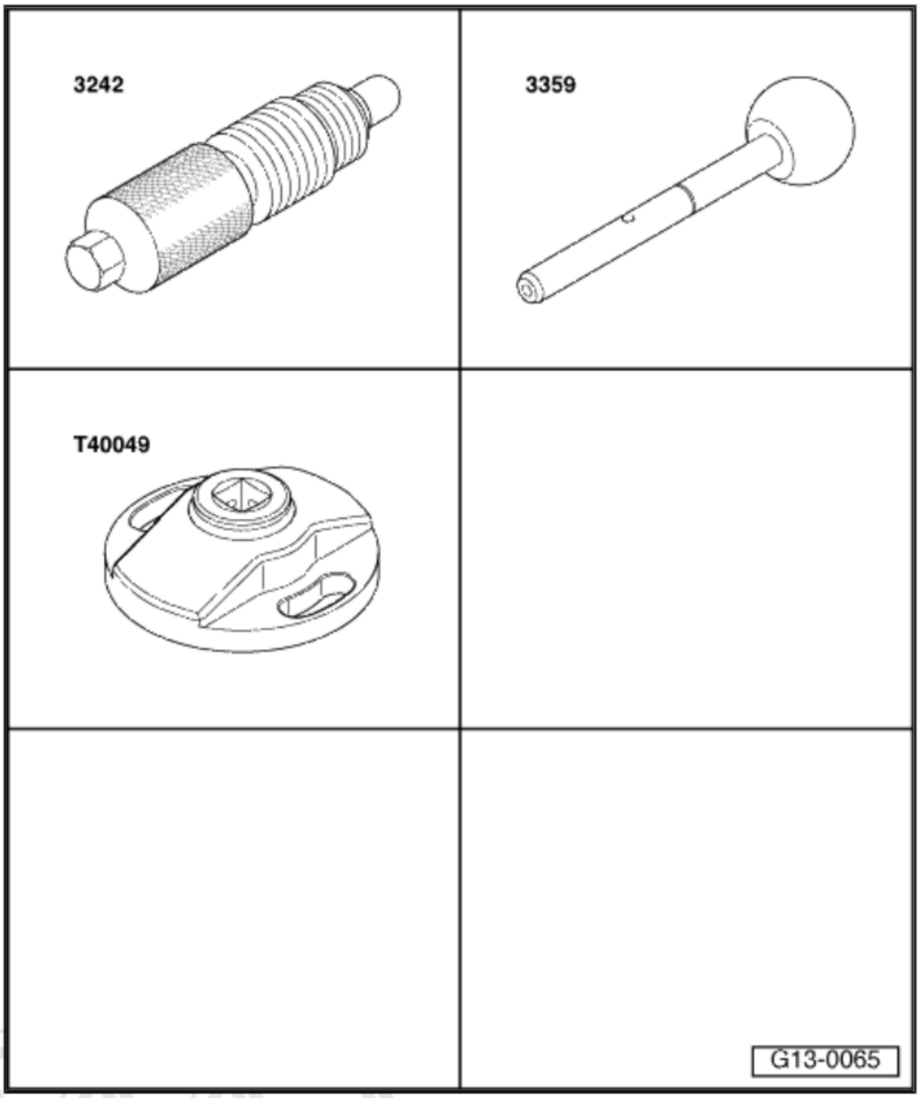
- ☐ If bolt cannot be tightened to torque, remove sump (bottom section) with baffle plate and counterhold oil pump drive shaft using an open-end spanner.



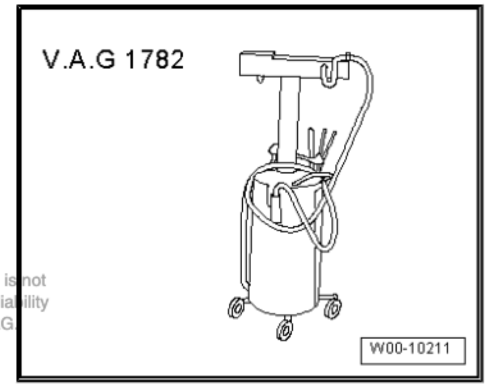
2.14 Removing and installing drive chain for oil pump and balance shaft

Special tools and workshop equipment required

- Locking pin -3242-
- Diesel injection pump locking pin -3359-
- Special wrench -T40049-



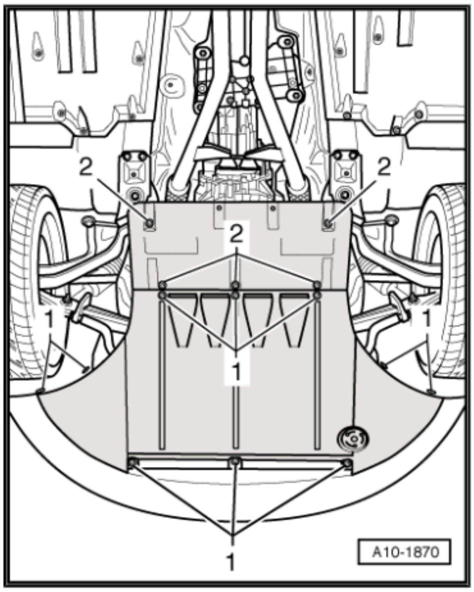
- Used oil collection and extraction unit -V.A.G 1782-



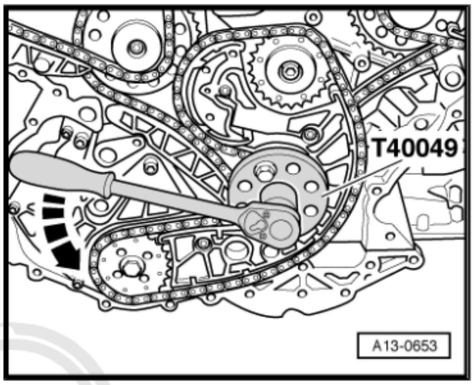
- Drill bit, ∅ 3.3 mm

Removing

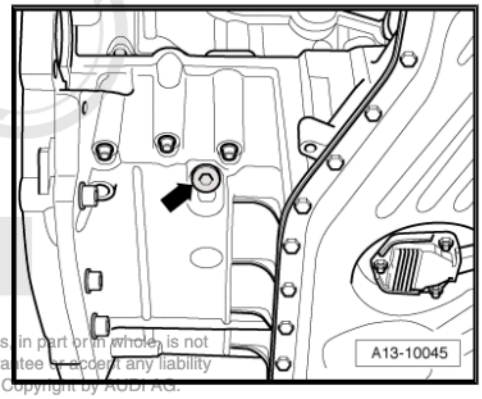
- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.
- Place used oil collection and extraction unit -V.A.G 1782- under engine.
- Drain off engine oil.
- Remove engine ⇒ page 8 .
- Separate engine from gearbox ⇒ page 27 .
- Secure engine to engine and gearbox support ⇒ page 34 , or leave engine on scissor-type assembly platform -VAS 6131 A- .
- Remove drive plate ⇒ page 66 .
- Remove timing chain covers ⇒ page 71 .



- Attach special wrench -T40049- at rear end of crankshaft using two old securing bolts for drive plate.

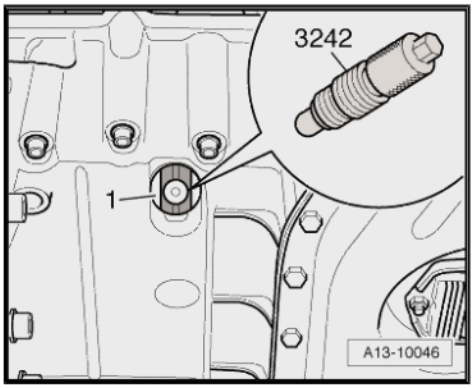


- Lay a cloth beneath sump (top section) to catch engine oil.
- Unscrew plug from sump (top section).



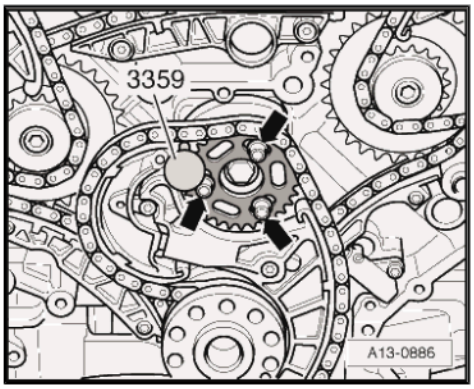
WARNING

To avoid any risk of injury, do not rotate the crankshaft while feeling for the TDC hole with your finger.

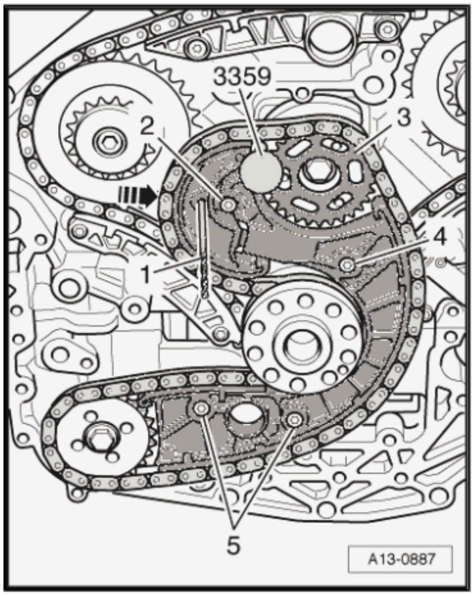


- Screw locking pin -3242- into bore (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.

- Mark running direction of chain for oil pump and balance shaft with paint.
- Lock balance shaft with diesel injection pump locking pin -3359- and loosen bolts -arrows- for balance shaft sprocket.

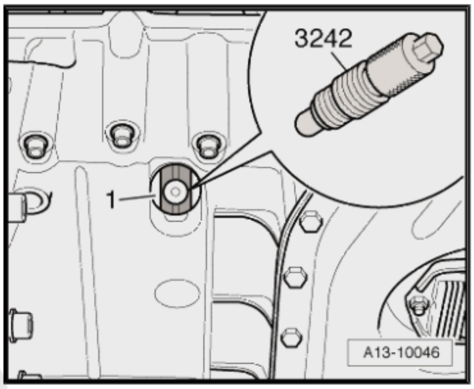


- Wrap insulating tape around tip and shaft of 3.3 mm ∅ drill bit to avoid cuts.
- Press guide rail of chain tensioner in direction of -arrow- and lock chain tensioner by inserting 3.3 mm ∅ drill bit -item 1-.
- Remove bolts -2-, -4- and -5- and take out chain tensioner, balance shaft sprocket -3- and chain.

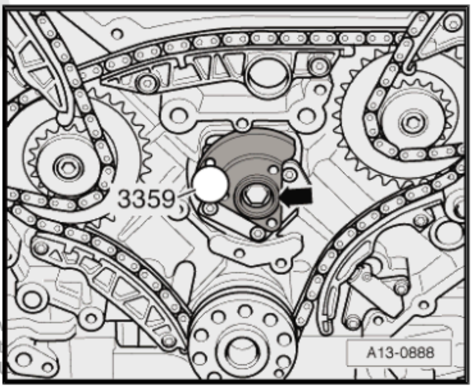


Installing

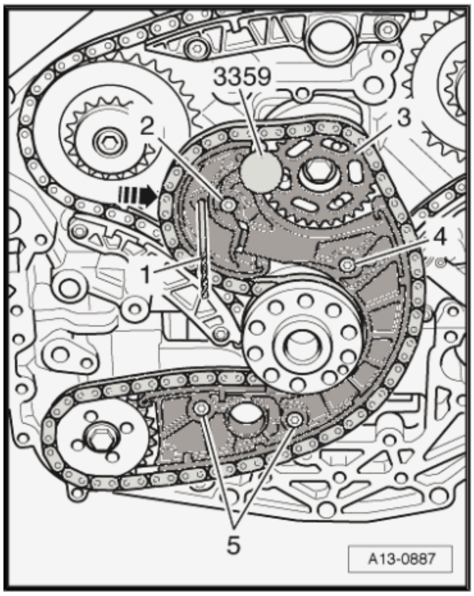
- Crankshaft -1- locked in TDC position with locking pin -3242- .



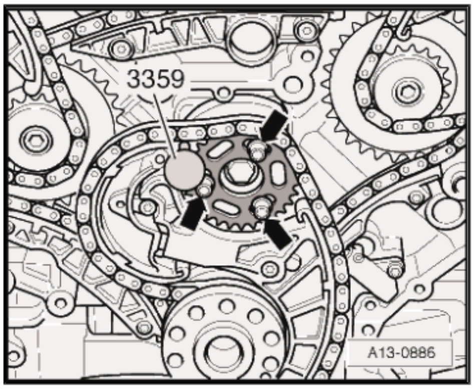
- Lock balance shaft -arrow- with diesel injection pump locking pin -3359-



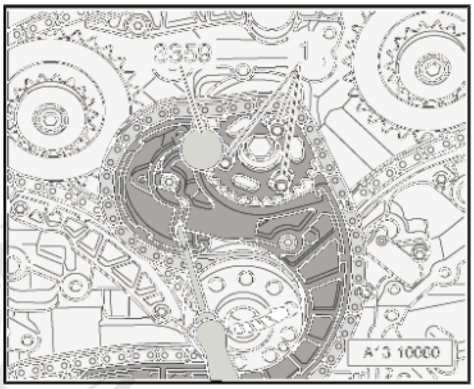
- Install chain tensioner with chain and balance shaft sprocket.
- The elongated holes in the sprocket -3- must be aligned centrally over the tapped holes in the balance shaft.
- Tighten bolts -2-, -4- and -5- for chain tensioner.



- Screw in bolts -arrows- for chain sprocket, but do not tighten.
- It should just be possible to turn the sprocket on the balance shaft without axial movement.



- Pull drill bit out of locating hole to release chain tensioner.
- Press against guide rail of chain tensioner using a screwdriver, and at the same time tighten bolts securing chain sprocket.
- Pull diesel injection pump locking pin -3359- out of balance shaft.



Remaining installation steps are carried out in reverse sequence; note the following:

- Install timing chain covers ⇒ page 74 .
- Install drive plate ⇒ page 66 .
- Bolt gearbox to engine and install engine/gearbox assembly ⇒ page 36 .
- Fill up with engine oil and check oil level ⇒ page 200 .

Tightening torques

Component	Nm
Chain tensioner to cylinder block	9
Chain sprocket for balance shaft to balance weight	23

2.15 Balance shaft - exploded view

1 - Sleeve bearing

2 - 60 Nm

- ☐ Counterhold with diesel injection pump locking pin -3359- when loosening and tightening

3 - Balance weight (timing chain end)

4 - 9 Nm

5 - Bearing plate

6 - Balance weight (pulley end)

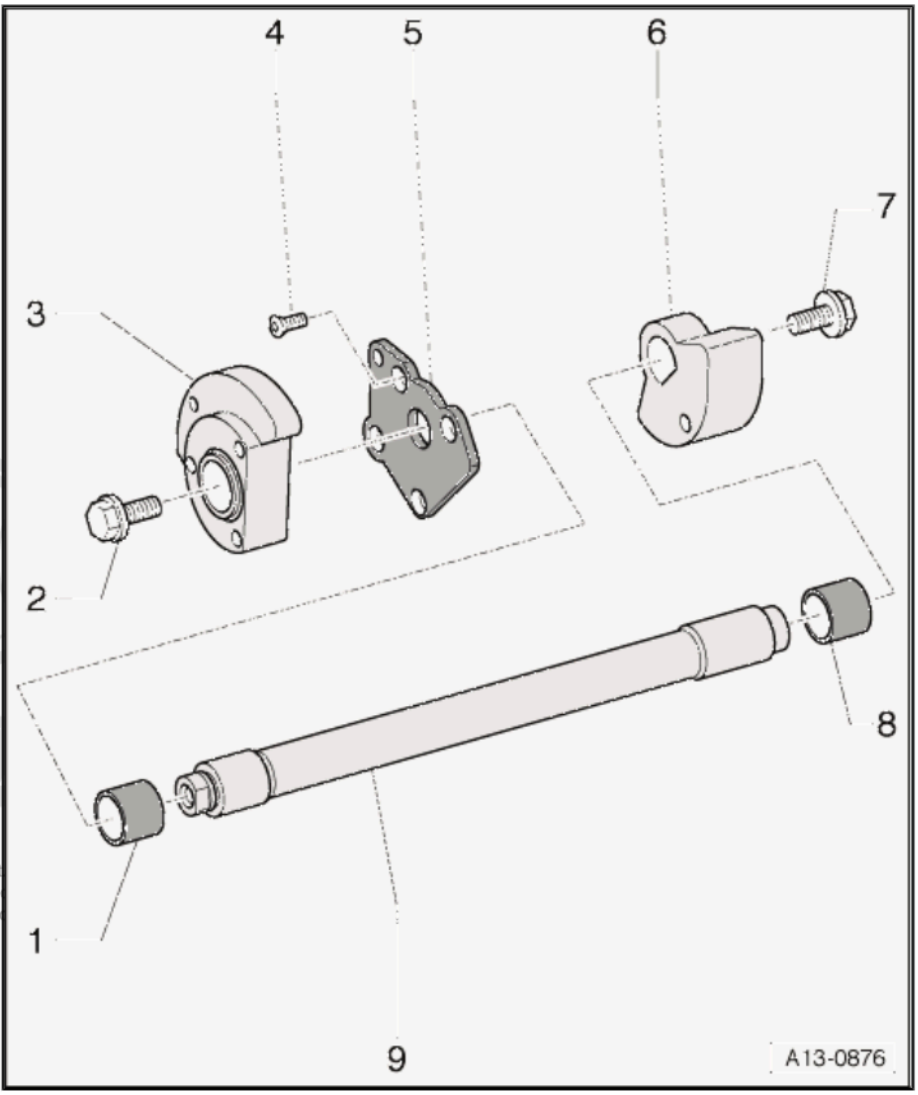
7 - 60 Nm

- ☐ Counterhold with diesel injection pump locking pin -3359- when loosening and tightening

8 - Sleeve bearing

9 - Balance shaft

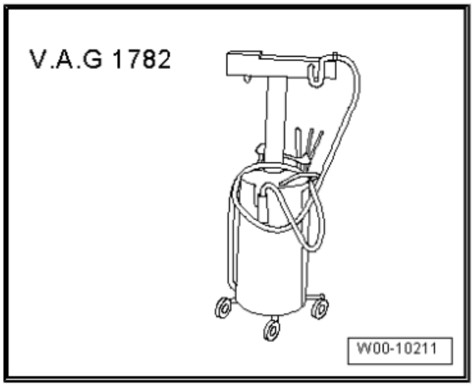
- ☐ Removing and installing ⇒ page 106



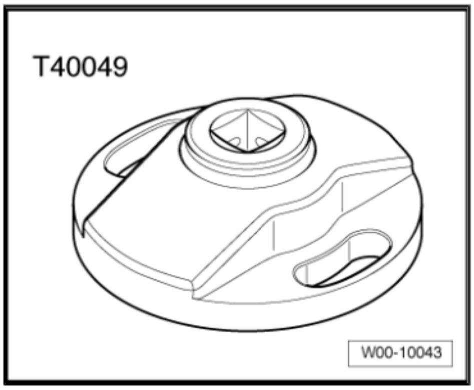
2.16 Removing and installing balance shaft

Special tools and workshop equipment required

- Used oil collection and extraction unit -V.A.G 1782-

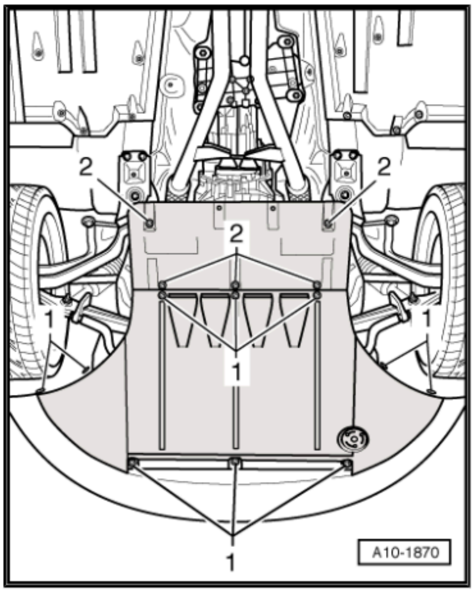


- ◆ Special wrench -T40049-



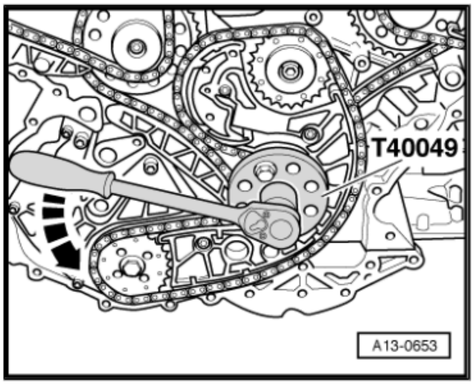
Removing

- – Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.



- – Place used oil collection and extraction unit -V.A.G 1782- under engine.
- – Drain off engine oil.
- – Remove engine ⇒ page 8 .
- – Separate engine from gearbox ⇒ page 27 .
- – Secure engine to engine and gearbox support ⇒ page 34 , or leave engine on scissor-type assembly platform -VAS 6131 A- .
- – Remove sealing flange (front) ⇒ page 61 .
- – Remove drive plate ⇒ page 66 .
- – Remove timing chain covers ⇒ page 71 .

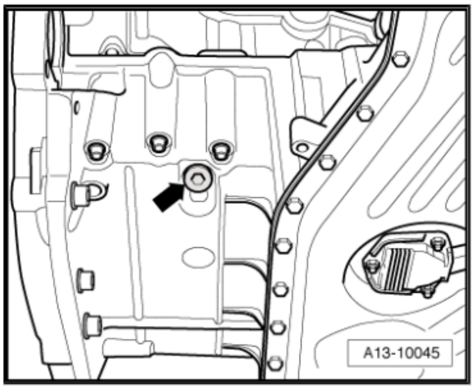
- – Attach special wrench -T40049- at rear end of crankshaft using two old securing bolts for drive plate.



Note

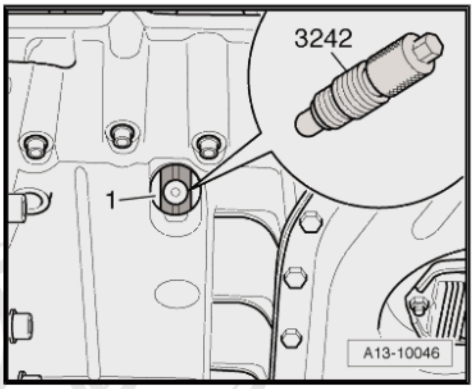
Disregard -arrow-.

- – Lay a cloth beneath sump (top section) to catch engine oil.
- – Unscrew plug from sump (top section).

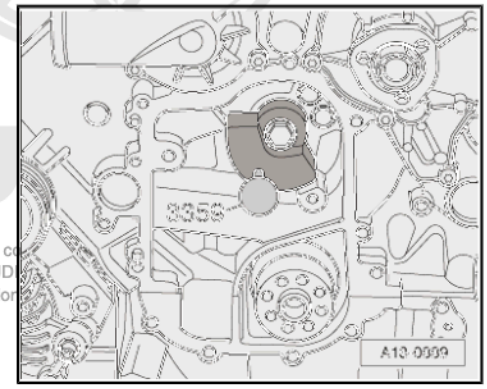


WARNING

To avoid any risk of injury, do not rotate the crankshaft while feeling for the TDC hole with your finger.

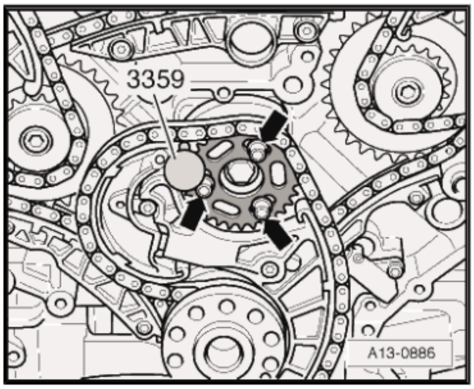


– Screw locking pin -3242- into bore (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.



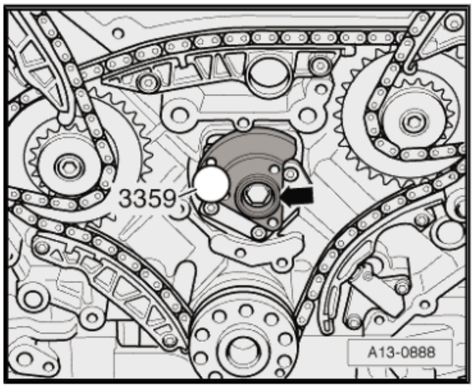
– Lock balance shaft at front of engine with diesel injection pump locking pin -3359-

– Unscrew bolt and detach balance weight from balance shaft.



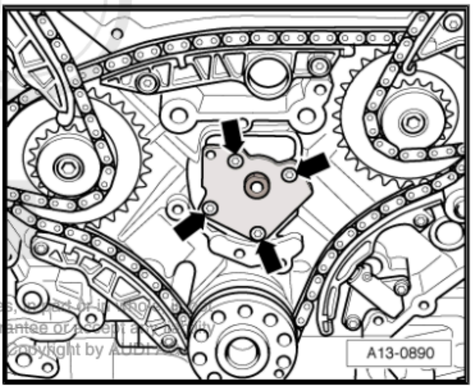
– Lock balance shaft at rear of engine with diesel injection pump locking pin -3359-

– Unscrew bolts -arrows- and detach chain sprocket from balance shaft.



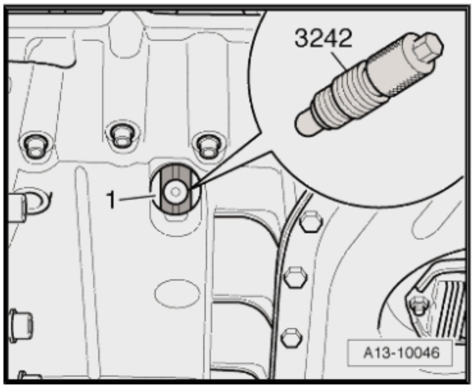
– Unscrew bolt -arrow- and detach balance weight from balance shaft.

- Unscrew bolts -arrows- and detach bearing plate for balance shaft.
- Pull balance shaft out of cylinder block.



Installing

- Crankshaft locked in TDC position with locking pin -3242- .



Installation is carried out in the reverse order; note the following:

- Install chain for oil pump and balance shaft ⇒ page 102
- Install timing chain covers ⇒ page 74 .
- Install drive plate ⇒ page 66 .
- Install sealing flange (front) ⇒ page 61 .
- Bolt gearbox to engine and install engine/gearbox assembly ⇒ page 36 .
- Fill up with engine oil and check oil level ⇒ page 200 .

Tightening torques

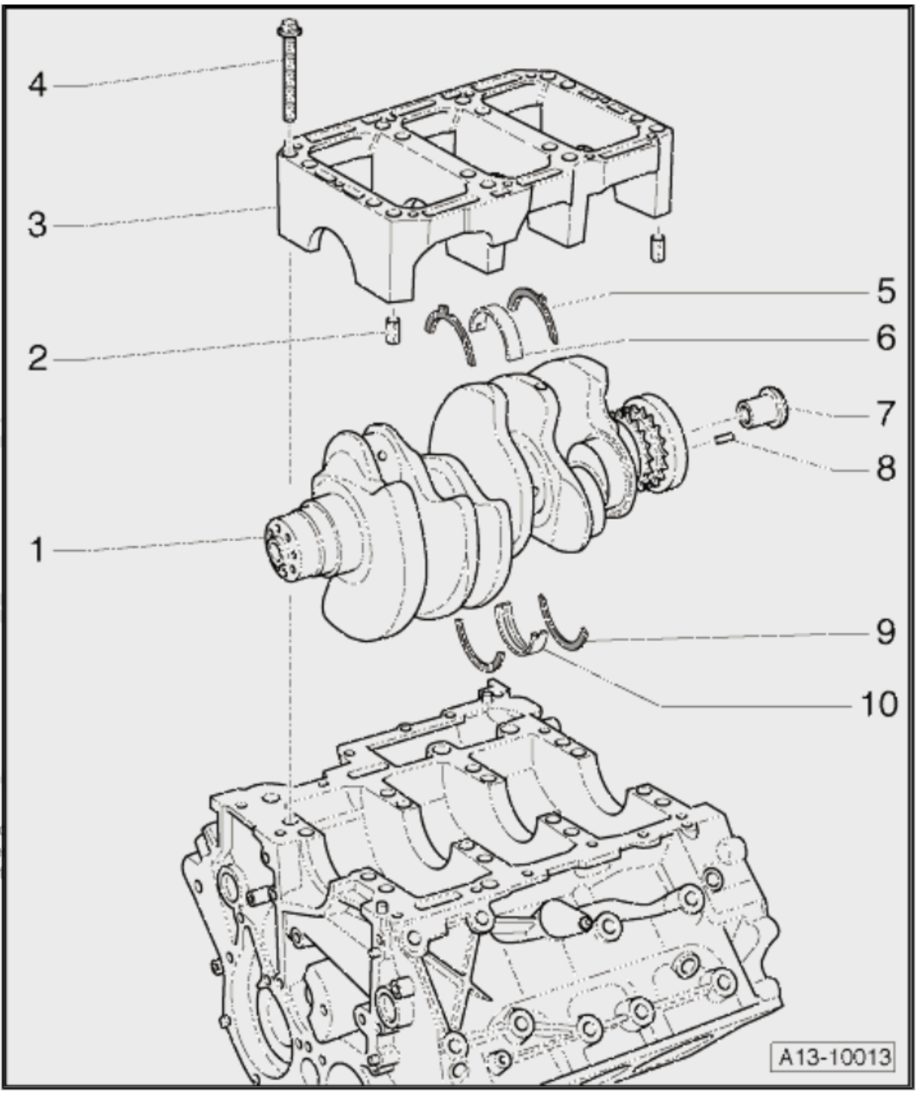
Component	Nm
Cover to cylinder block	9
Balance weight to balance shaft	60

3 Removing and installing crankshaft

Note

When carrying out repairs, secure engine to engine and gearbox support -VAS 6095- ⇒ page 34 .

3.1 Crankshaft - exploded view



1 - Crankshaft

- ☐ Measuring axial clearance ⇒ page 112
- ☐ Measuring radial clearance ⇒ page 113
- ☐ Do not rotate the crankshaft when checking the radial clearance
- ☐ Crankshaft dimensions ⇒ page 112

2 - Dowel sleeve

- ☐ 2x
- ☐ Insert in cylinder block

3 - Retaining frame

- ☐ Installing ⇒ page 111

4 - Bolt

- ☐ Renew
- ☐ Tightening sequence ⇒ page 111

5 - Thrust washer

- ☐ Only fitted on 3rd crankshaft bearing
- ☐ Oil grooves face outwards
- ☐ Note location
- ☐ Measuring axial clearance of crankshaft ⇒ page 112

6 - Bearing shell

- ☐ For retaining frame
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Bearing shells worn down to nickel layer must be renewed
- ☐ Install new bearing shells for retaining frame with correct coloured markings ⇒ page 112

7 - Centring sleeve for torque converter

- ☐ For vehicles with automatic gearbox ⇒ page 112

8 - Dowel pin

- ☐ Check that pin is firmly seated in crankshaft

9 - Thrust washer

- ☐ Only fitted on 3rd crankshaft bearing
- ☐ Oil grooves face outwards

- ☐ Note location
- ☐ Measuring axial clearance of crankshaft ⇒ page 112

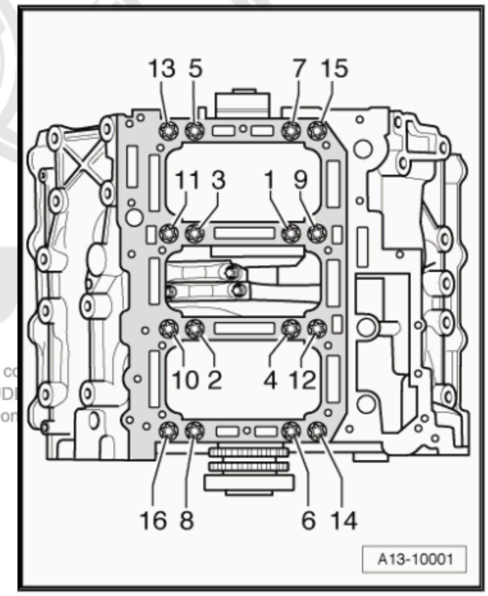
10 - Bearing shell

- ☐ For cylinder block (with oil groove)
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Install new bearing shells for the cylinder block with the correct coloured markings ⇒ page 111

Installing retaining frame

- – Renew bolts -1 … 16-.
- – Fit both dowel sleeves into retaining frame.
- – Tighten securing bolts for retaining frame in the following sequence:

1. Tighten bolts -1 ... 16- to 30 Nm with torque wrench.
2. Tighten bolts -1 ... 16- to 50 Nm with torque wrench.
3. Turn bolts -1 ... 16- 90° further ($^1/_4$ turn) using a rigid wrench.



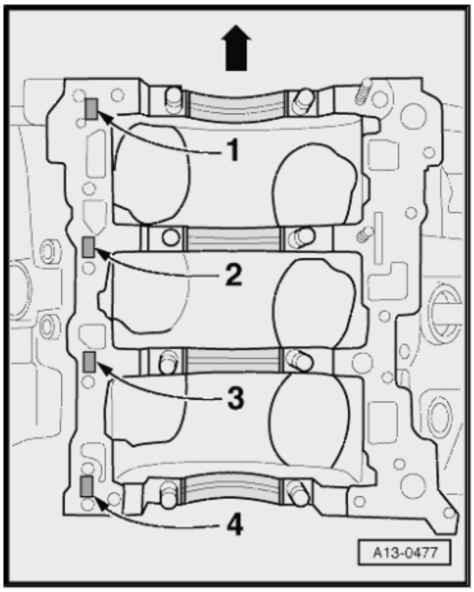
Matching crankshaft bearing shells to bearings in cylinder block

Bearing shells of the correct thickness are matched to the bearings in the cylinder block at the factory. Coloured dots on the bearing shells are used to identify the bearing shell thickness.

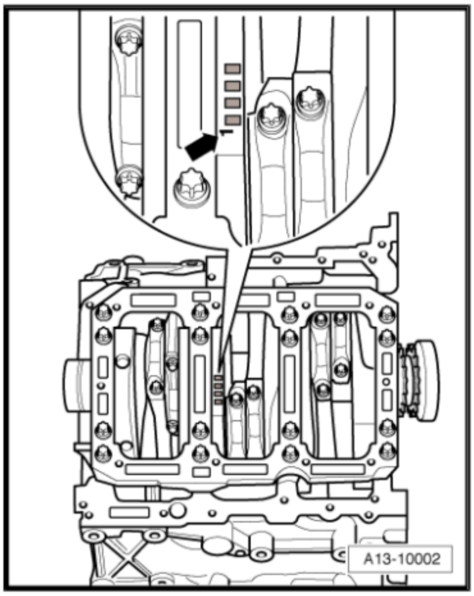
- The -arrow- points to pulley end.

The allocation of the bearing shells to the cylinder block is identified by a code letter next to the relevant bearing.

Letter on cylinder block	Colour coding of bearing
R =	Red
G =	Yellow
B =	Blue



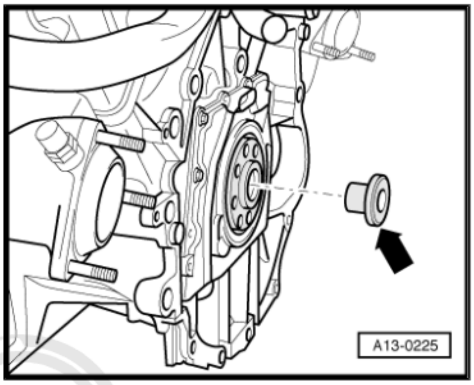
Matching crankshaft bearing shells to bearings in retaining frame



- Bearing shells of the correct thickness are assigned to the bearing caps at the factory. Coloured dots on the bearing shells are used to identify the bearing shell thickness.
- The correct allocation of bearing shells to crankshaft is indicated by a sequence of letters on the crankshaft web. The number „1“ -arrow- preceding the sequence of letters indicates the colour code for No. 1 bearing.

Letter on crankshaft	Colour coding of bearing
R =	Red
G =	Yellow
B =	Blue

Bearing bush for torque converter



– On vehicles with automatic gearbox, check that bearing bush -arrow- is inserted in rear of crankshaft. Drive in bearing bush if necessary.

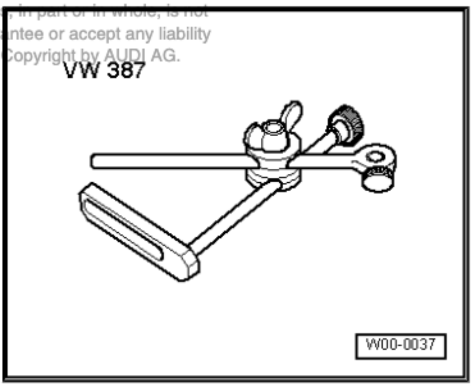
3.2 Crankshaft dimensions

Honing dimension (in mm)	Crankshaft main bearing journal ∅	Crankshaft conrod journal ∅
Basic dimension	65.000 – 0.022 – 0.042	60.000 – 0.022 – 0.042

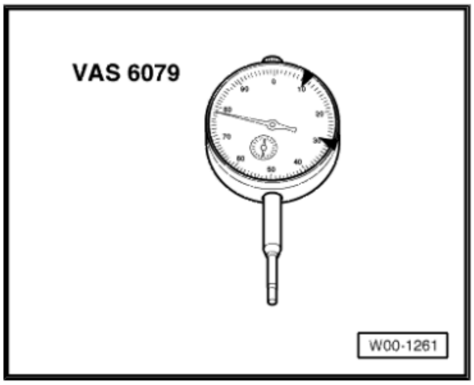
3.3 Measuring axial clearance

Special tools and workshop equipment required

- Universal dial gauge bracket -VW 387-

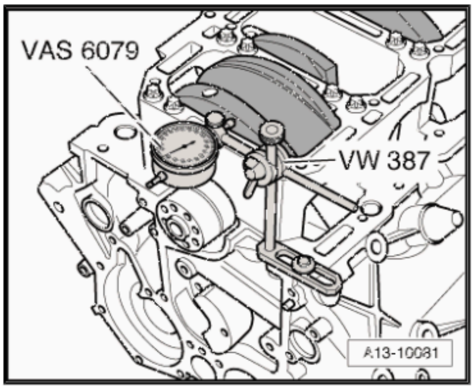


- ♦ Dial gauge -VAS 6079-



Procedure

- – Bolt dial gauge with universal dial gauge bracket -VW 387- onto cylinder block and apply gauge against crank web.
- – Press crankshaft against dial gauge by hand and set gauge to „0“.
- – Push crankshaft away from dial gauge and read off value.



Axial clearance:

- New: 0.090 ... 0.215 mm.
- Wear limit: 0.280 mm.

3.4 Measuring radial clearance

Special tools and workshop equipment required

- ♦ Plastigage

Procedure

Note

- ♦ *Do not interchange used bearings.*
- ♦ *Bearing shells worn down to nickel layer must be renewed.*

- – Remove retaining frame and clean bearing journals.
- – Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.
- The Plastigage must be positioned in the centre of the bearing shell
- – Fit retaining frame and tighten to 30 Nm. Do not rotate crankshaft.
- – Remove retaining frame once more.
- – Compare width of Plastigage with measurement scale:

Radial clearance:

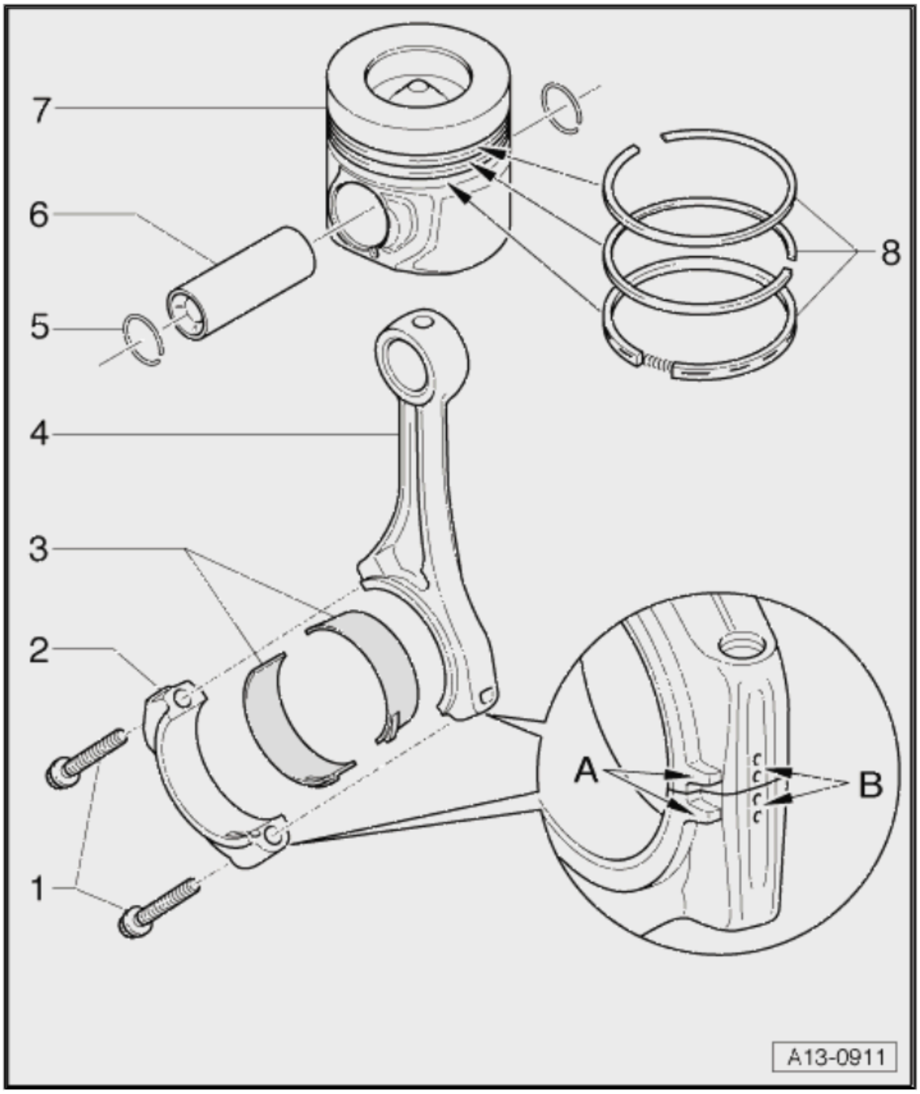
- New: 0.018 ... 0.045 mm.
- Wear limit: 0.10 mm.

4 Dismantling and assembling pistons and conrods

Note

Oil spray jet for piston cooling ⇒ page 115 .

4.1 Pistons and conrods - exploded view



1 - Conrod bolt, 30 Nm + 90° ($^{1}/_{4}$ turn) further
- ☐ Renew
- ☐ Lubricate threads and contact surface
- ☐ To measure radial clearance, tighten to 30 Nm but do not turn further

2 - Conrod bearing cap
- ☐ Do not interchange
- ☐ Mark cylinder allocation with a coloured pen -B- ⇒ page 116
- ☐ Installation position: Note position of lugs on casting -A-

3 - Bearing shells
- ☐ Note installation position
- ☐ Do not interchange used bearing shells (mark positions)
- ☐ Bearing shells worn down to nickel layer must be renewed
- ☐ Measuring radial clearance ⇒ page 119
- ☐ To measure radial clearance, tighten bolts ⇒ Item 1 (page 114) to 30 Nm but do not turn further

4 - Conrod
- ☐ Only renew as a complete set
- ☐ Mark cylinder allocation with a coloured pen -B- ⇒ page 116
- ☐ Installation position: Note position of lugs on casting -A-
- ☐ Axial clearance for each conrod pair (when new): 0.20 … 0.44 mm

5 - Circlip

6 - Piston pin
- ☐ If difficult to move, heat piston to approx. 60 °C
- ☐ Remove and install using drift -VW 222 A-

7 - Piston
- ☐ With combustion chamber

- ☐ Mark installation position and cylinder number ⇒ page 116
- ☐ Checking ⇒ page 116
- ☐ Install using piston ring clamp
- ☐ If cracking is visible on piston skirt, renew piston
- ☐ Piston and cylinder dimensions ⇒ page 119
- ☐ Checking piston projection at TDC ⇒ page 117
- ☐ Checking cylinder bore ⇒ page 116

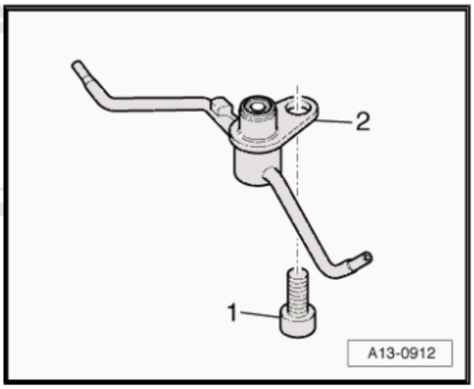
8 - Piston rings

- ☐ Offset gaps by 120°
- ☐ Use piston ring pliers to remove and install
- ☐ „TOP“ must face towards piston crown
- ☐ Checking ring gap ⇒ page 115
- ☐ Checking ring-to-groove clearance ⇒ page 115

Oil spray jet for piston cooling

1 - Bolt, 9 Nm

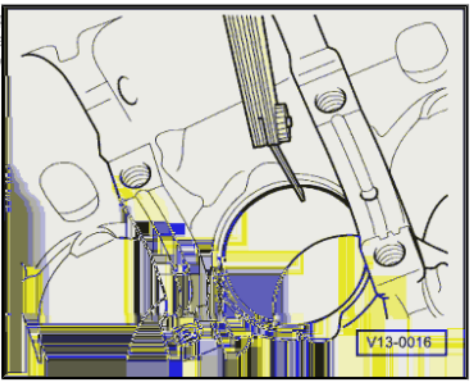
2 - Oil spray jet with spray nozzle valve for piston cooling



Checking piston ring gap

– Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. Use a piston without rings to push ring into bore.

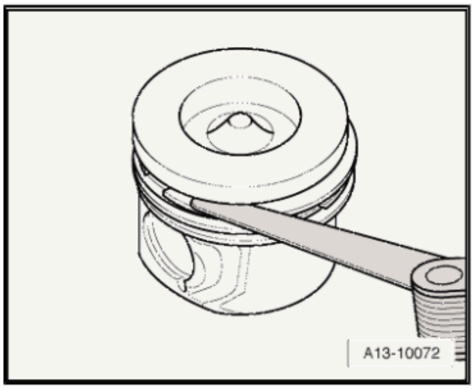
Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.25 … 0.38	0.80
2nd compression ring	0.70 … 0.90	1.30
Oil scraper ring	0.40 (maximum)	0.70



Checking ring-to-groove clearance

– Clean groove in piston before checking clearance.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.120 … 0.160	0.175
2nd compression ring	0.020 … 0.090	0.115
Oil scraper ring	0.020… 0.090	0.115

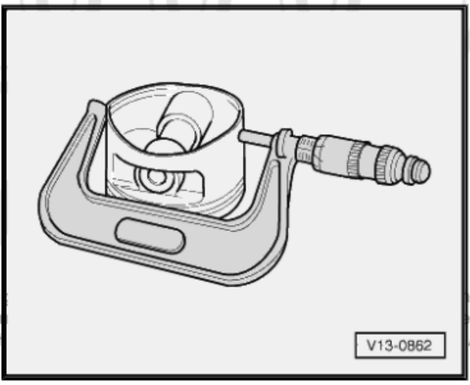


Checking piston

– Using a micrometer (75 ... 100 mm), measure approx. 10 mm from the lower edge, perpendicular to the piston pin axis.

- Maximum deviation from nominal dimension: 0.05 mm.

Nominal dimension
⇒ „4.3 Piston and cylinder dimensions“, page 119 .



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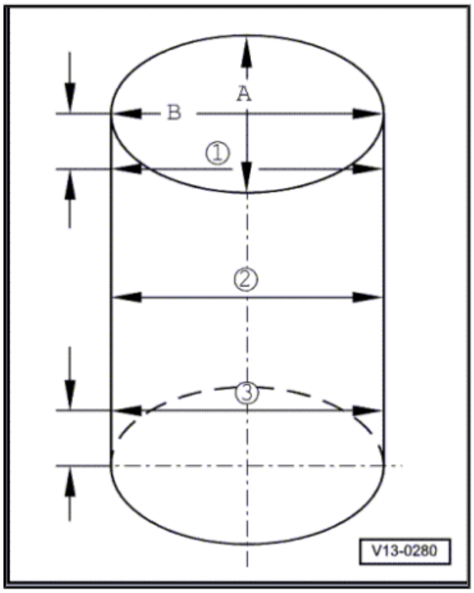
Checking cylinder bore

– Use 50 ... 100 mm internal dial gauge to take measurements at 3 points in transverse direction -A- and longitudinal direction -B-.

- Maximum deviation from nominal dimension: 0.08 mm.

Nominal dimension
⇒ „4.3 Piston and cylinder dimensions“, page 119 .



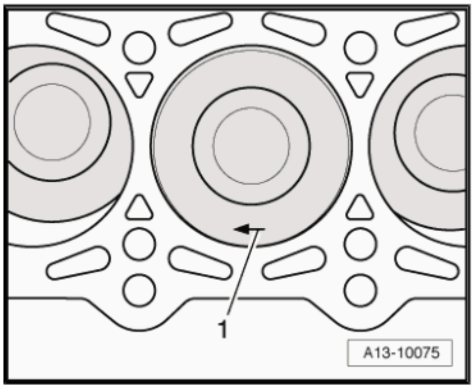
Installation position of pistons

- Installation position: Arrow -item 1- on piston crown points to pulley end.

Note

◆ *If used pistons are being re-installed, use chalk or waterproof felt-tip pen to mark installation position and cylinder number on piston crown.*

◆ *Do not use a centre punch or scriber, as this would damage the coating of the piston crown.*



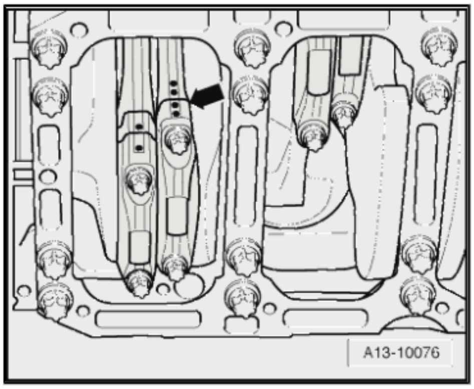
Marking conrods

– Before removing, mark mating positions of conrods and conrod bearing caps with coloured pen -arrow-.

Note

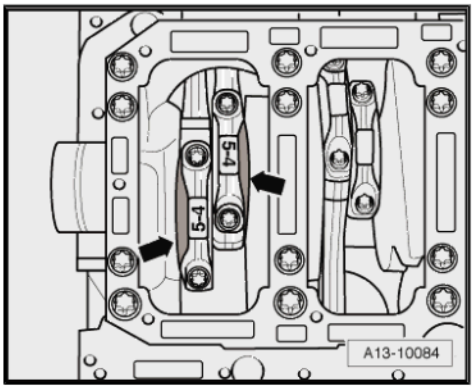
◆ *Only renew conrods as a complete set.*

◆ *Do not interchange conrod bearings.*



Conrod installation position

The larger contact shoulder on the conrod -arrows- faces towards the adjacent main bearing.



Note

Illustration shows front pair of conrods.

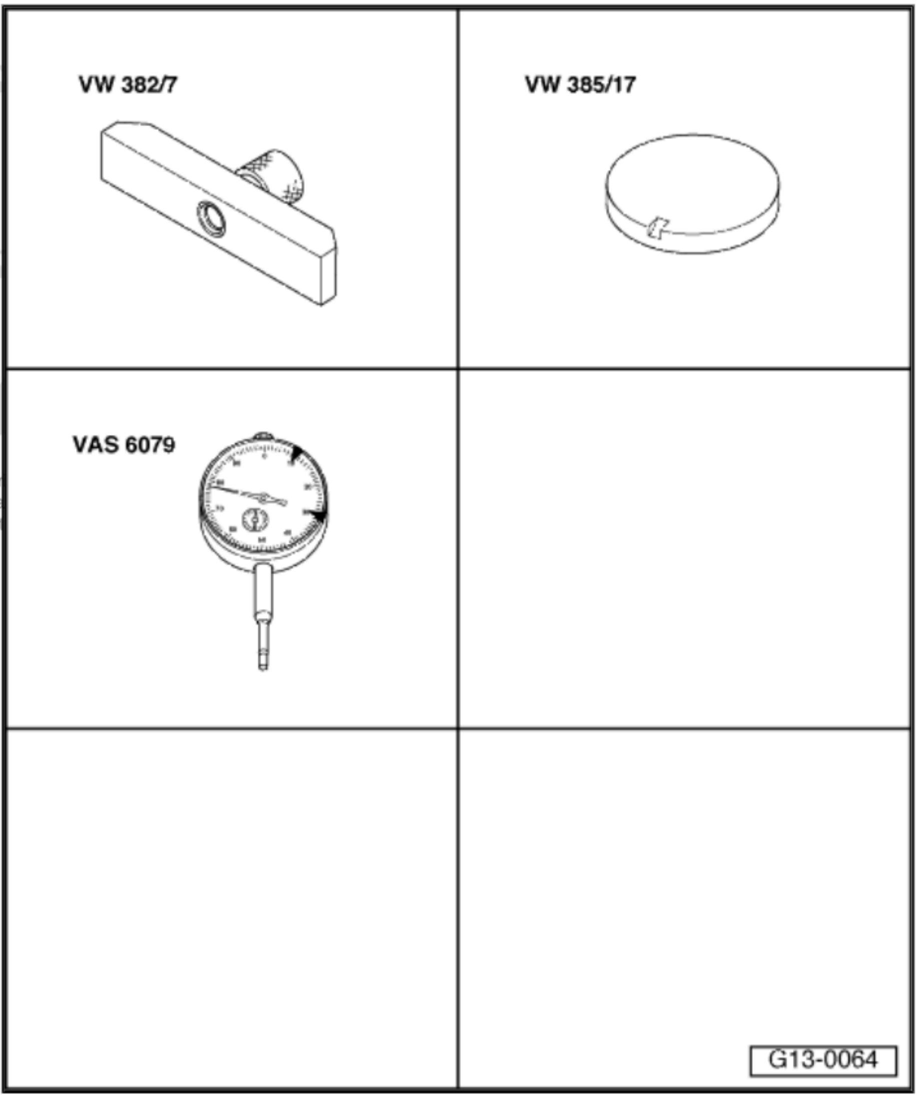
4.2 Checking piston projection at TDC

Note

- *Piston projection at „TDC“ must be measured when installing new pistons or a short engine. Depending upon piston projection, install the corresponding cylinder head gasket according to the table below:*
- *If the measured values for piston projection are not the same for all pistons, use the highest value to determine the correct gasket size.*
- *The cylinder head gasket must be determined separately for each cylinder bank.*

Special tools and workshop equipment required

- Measuring bridge -VW 382/7- from measuring tool -VW 382-
- Measuring plate - VW 385/17- from universal measuring tool -VW 385-
- Dial gauge -VAS 6079-

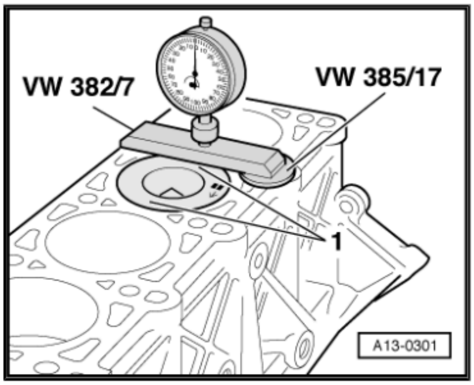


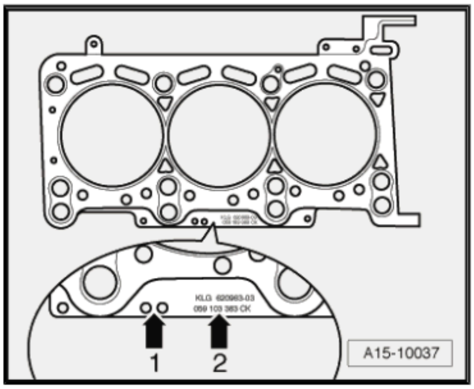
Procedure

– Set up dial gauge -VAS 6079- with measuring bridge -VW 382/7- and measuring plate -VW 385/17- .

– Measure piston projection at two points -1- for each piston.

Piston projection above top surface of cylinder block	Identification (No. of holes)
0.39 … 0.49 mm	1
0.49 … 0.54 mm	2
0.54 … 0.65 mm	3





Identification of cylinder head gasket

1 - Holes

2 - Part No.

Note

The gaskets for the left and right cylinder heads have different shapes and cannot be interchanged.

4.3 Piston and cylinder dimensions

Honing dimension (in mm)	Piston ∅	Cylinder bore ∅
Basic dimension	82.939 … 82.951 [1]	83.006 … 83.014
Repair oversize	82.979 … 82.991 [1]	83.046 … 83.054
- [1] Dimensions not including graphite coating (thickness 0.02 mm). The graphite coating will wear down in service.		

4.4 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

- Plastigage

Procedure

- Remove conrod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.
- Fit conrod bearing cap and tighten to 30 Nm. Do not rotate crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigage with measurement scale:

Radial clearance:

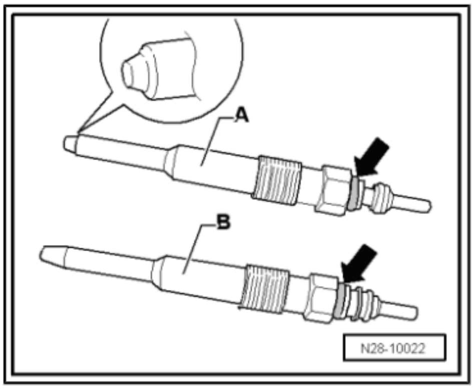
- New: 0.015 ... 0.062 mm.
- Wear limit: 0.12 mm.

- Renew conrod bolts.

15 – Cylinder head, valve gear

1 Handling ceramic glow plugs

Up to autumn 2004, two different types of glow plugs are fitted in the Audi A8 with 6-cylinder 3.0 ltr. TDI engine; from autumn 2004 onwards, these engines are fitted exclusively with metal glow plugs. Distinguishing features:



A - Ceramic glow plugs are colour-coded with a „white seal“ -arrow- and have a chamfered shoulder at the tip.

B - Metal glow plugs are colour-coded with a „red seal“ -arrow-.

The metal glow plugs do not require any special handling procedures.

Important: Note the following points regarding ceramic glow plugs:

Caution

- *Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28 .*
- *Transport and store only in original packaging or packed separately in bubble wrap.*
- *Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.*
- *Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).*
- *Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.*
- *Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.*
- *If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).*
- *The software of the engine control unit is programmed specifically for either the ceramic or the metal glow plugs, so it is important to install the correct type.*
- *Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.*

2 Removing and installing cylinder head

2.1 Cylinder head - exploded view

Note

The diagram shows the cylinder head on cylinder bank 2 (left-side).

1 - Cylinder head

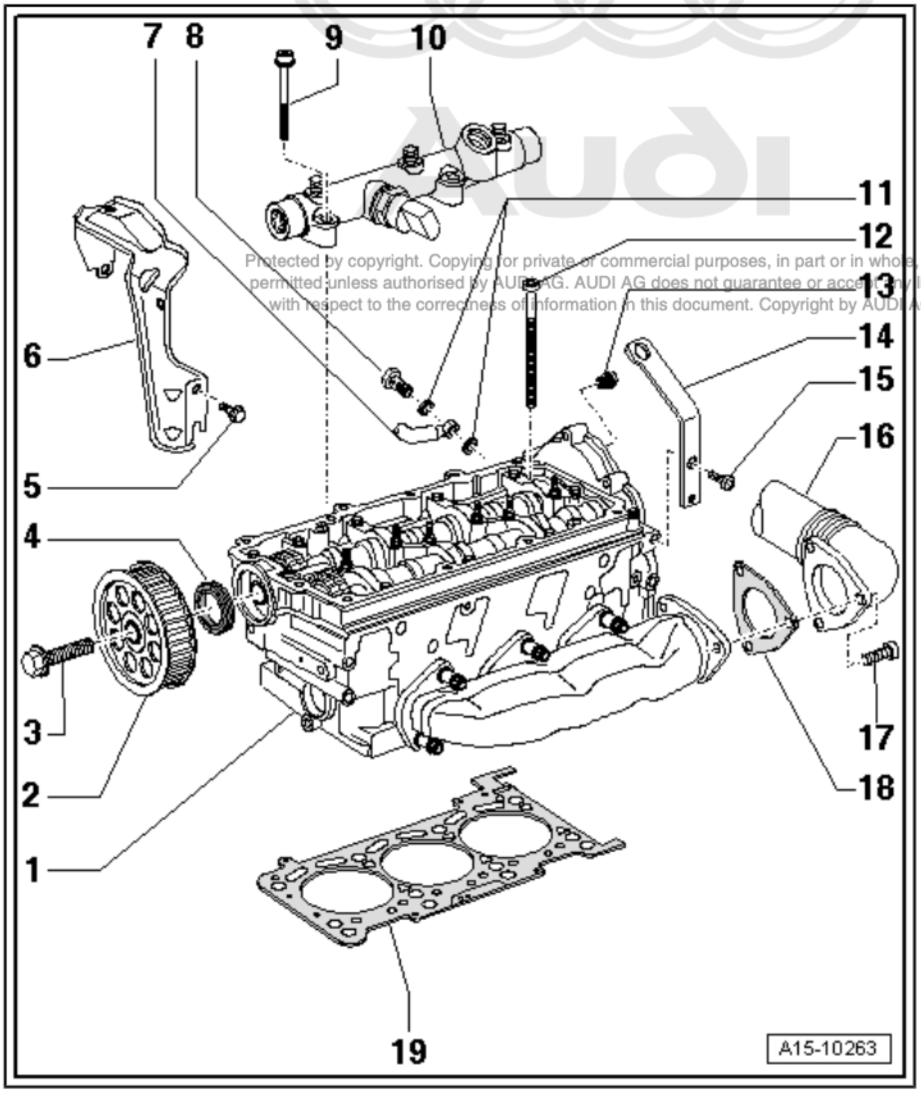
Caution

- *Vehicles with ceramic glow plugs: The ceramic glow plugs fitted in this engine are very easily damaged and project slightly beyond the cylinder head gasket surface, so do NOT lay the cylinder head down on the gasket side while the glow plugs are still installed.*
- *Handling ceramic glow plugs ⇒ page 120 .*

- Removing: vehicles up to 08.2005 ⇒ page 132 ; vehicles from 08.2005 onwards ⇒ page 135
- Checking for distortion ⇒ page 123
- Cylinder heads must not be machined on diesel engines
- Installing ⇒ page 138
- If renewed, change coolant and engine oil

2 - Toothed belt drive sprocket

- Use counterhold tool -3036- when loosening and tightening central bolt ⇒ page 122



- Pulling off: vehicles up to 03.2006 ⇒ page 123 ; vehicles from 03.2006 onwards ⇒ page 123

3 - 75 Nm

- Use counterhold tool -3036- when loosening and tightening ⇒ page 122

4 - Oil seal for toothed belt sprocket for high-pressure pump

- Renewing ⇒ page 148

5 - 9 Nm

6 - Bracket for oil dipstick

7 - Coolant pipe/hose

8 - Banjo bolt, 15.5 Nm

9 - 23 Nm

10 - Rail element

- ❑ Observe rules for cleanliness ⇒ page 6
- ❑ Do not attempt to bend high-pressure pipes to a different shape
- ❑ Tightening high-pressure pipe connections at rail elements ⇒ page 126

11 - Seals

- ❑ Renew

12 - Cylinder head bolt

- ❑ Renew
- ❑ Observe sequence when loosening: vehicles up to 08.2005 ⇒ page 134 ; vehicles from 08.2005 onwards ⇒ page 137
- ❑ Note correct sequence when tightening ⇒ page 142

13 - Oil retention valve

- ❑ Tighten to 25 Nm

14 - Lifting eye

15 - M6: 9 Nm; M8: 23 Nm

16 - Intermediate pipe (left-side)

- ❑ Removing and installing ⇒ page 292

17 - 30 Nm + 90° ($^1/_4$ turn) further

- ❑ Type of connection differs depending on version ⇒ page 124

18 - Gasket

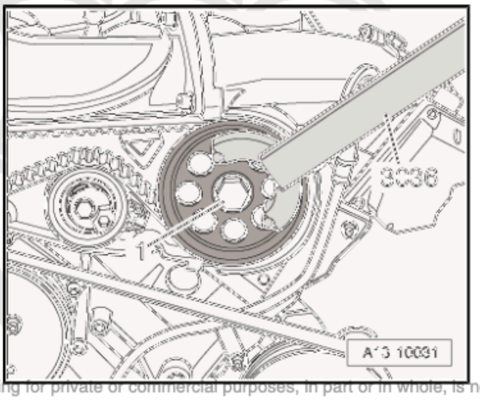
- ❑ Renew

19 - Cylinder head gasket

- ❑ Renewing: vehicles up to 08.2005 ⇒ page 132 ; vehicles from 08.2005 onwards ⇒ page 135
- ❑ Identification ⇒ page 123
- ❑ Installation position: Part No. towards cylinder head
- ❑ If renewed, change coolant and engine oil

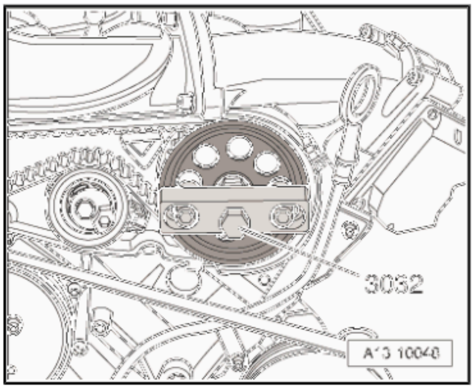
Loosening and tightening central bolt for toothed belt drive sprocket

– Use counterhold tool -3036- when loosening and tightening central bolt -1-.



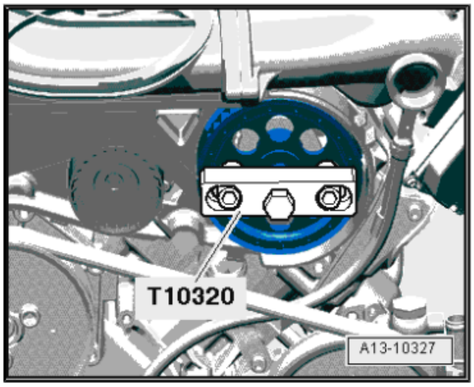
Pulling off toothed belt drive sprocket (versions up to 03.2006)

– Use puller -3032- to pull off toothed belt drive sprocket.



Pulling off toothed belt drive sprocket (versions from 03.2006 onwards)

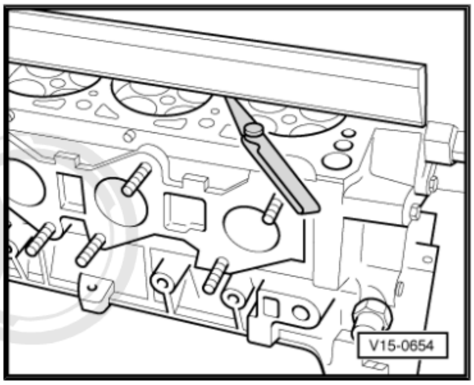
– Use puller -T10320- to pull off toothed belt drive sprocket.



Checking cylinder head for distortion

– Use straight edge and feeler gauge to measure for distortion at several points.

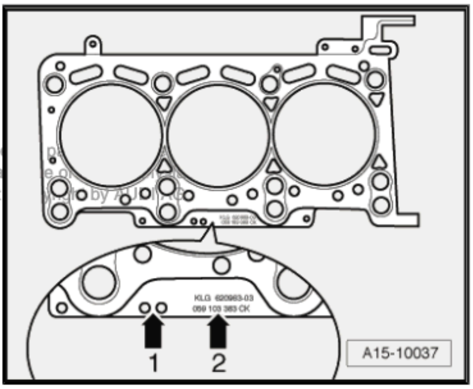
- Maximum permissible distortion: 0.1 mm.



Identification of cylinder head gasket

1 - Holes

2 - Part No.



Note

The gaskets for the left and right cylinder heads have different shapes and cannot be interchanged.

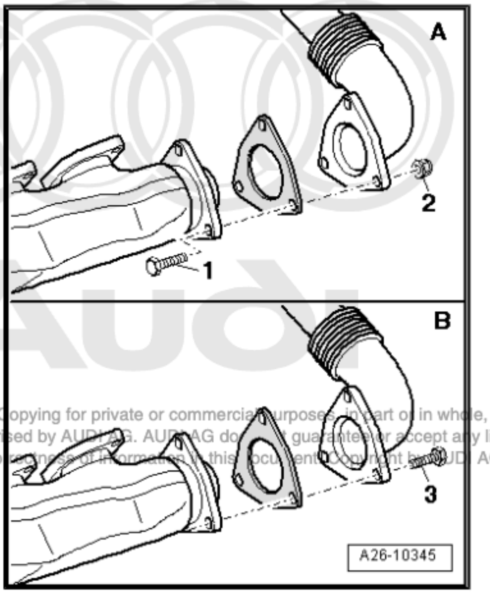
Securing intermediate pipe to exhaust manifold

A - Exhaust manifold (sheet metal version)

- Fitted with bolts -1- and nuts -2-.
- Renew bolts and nuts.
- Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

B - Exhaust manifold (cast version)

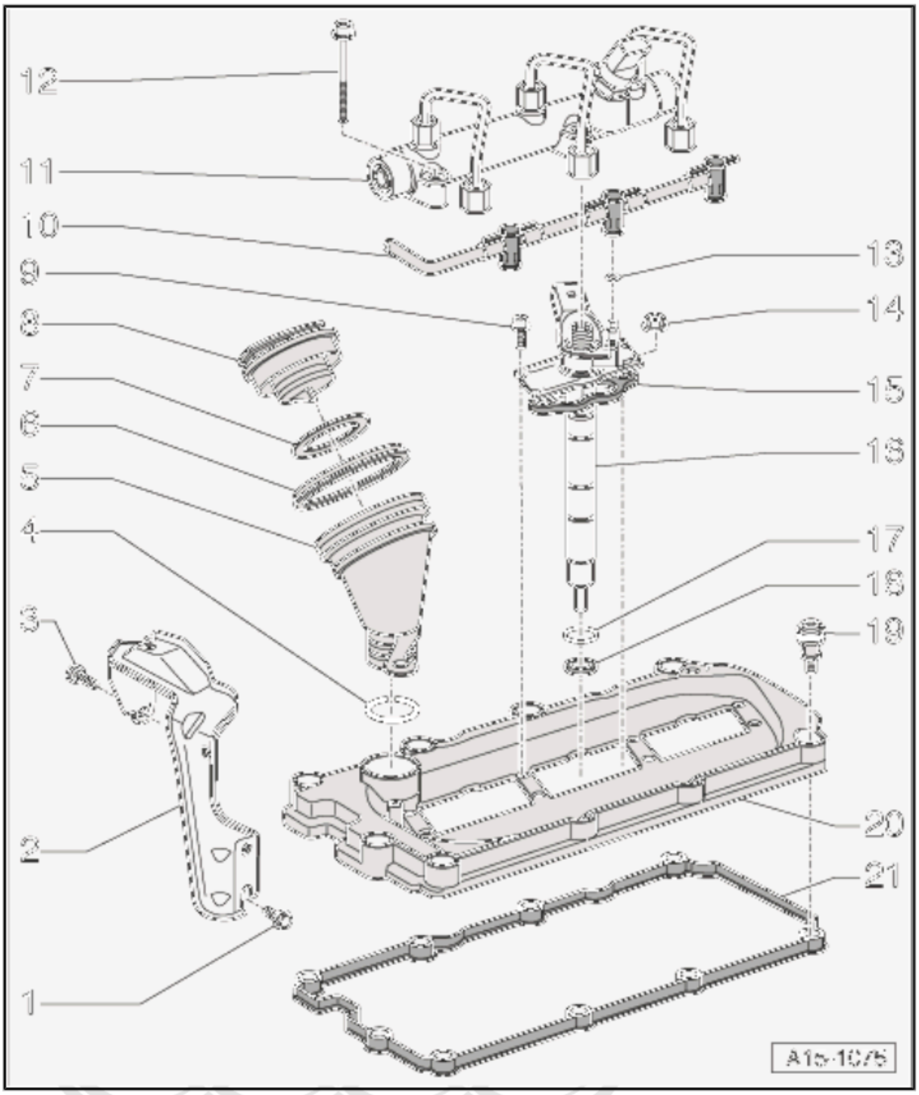
- Fitted with bolts -3-.
- Renew bolts.
- Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue



2.2 Cylinder head cover - exploded view

Note

Diagram shows cylinder head cover on cylinder bank 2 (left-side).



1 - 9 Nm

2 - Bracket for intake connecting pipe

3 - 9 Nm

4 - O-ring

- ☐ Renew

5 - Oil filler neck

- ☐ To remove: Lift tab, turn oil filler neck anti-clockwise and take out

6 - Seal

7 - Seal

- ☐ Renew if damaged or leaking

8 - Filler cap

9 - 5 Nm

10 - Fuel return pipe

- ☐ Observe rules for cleanliness ⇒ page 6

11 - Rail element

- ☐ With high-pressure pipes
- ☐ Observe rules for cleanliness ⇒ page 6
- ☐ Tightening high-pressure pipe connections at rail elements ⇒ page 126
- ☐ Tightening high-pressure pipe connections at injectors ⇒ page 126
- ☐ Do not attempt to bend high-pressure pipes to a different shape

12 - 23 Nm

13 - O-ring

- ☐ Renew

14 - 9 Nm

- ☐ Tighten alternately in stages

15 - Clamping piece

- ☐ Must be renewed if injector is renewed

16 - Injector

- ☐ Observe rules for cleanliness ⇒ page 6
- ☐ Removing and installing ⇒ „2.3 Removing and installing cylinder head cover“, page 127
- ☐ When an injector is renewed, also renew the high-pressure pipe and clamping piece at the same time

17 - O-ring

- ☐ Renew

18 - Copper seal

- ☐ Renew

19 - Special bolt, 9 Nm

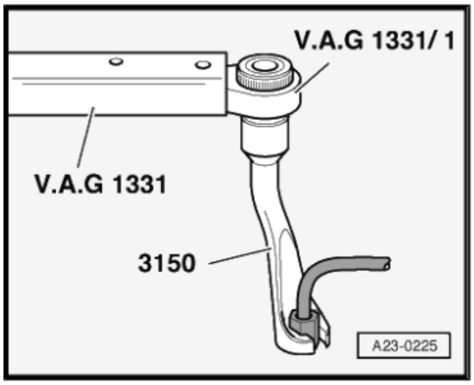
- ☐ Renew if damaged or leaking
- ☐ Tighten in stages and in diagonal sequence

20 - Cylinder head cover

- ☐ Removing and installing ⇒ page 127

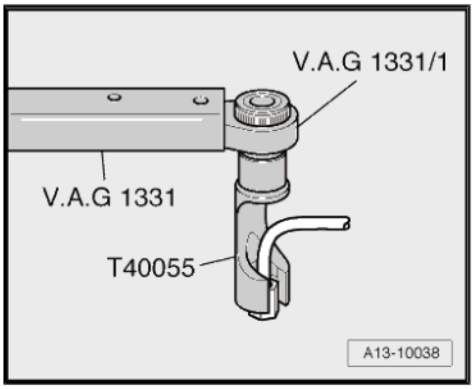
21 - Gasket for cylinder head cover

- ☐ Renew if damaged or leaking



Tightening high-pressure pipe connections at rail elements

- – Tighten union nuts on high-pressure pipes hand-tight initially.
- – Ensure that high-pressure pipes are not under tension.
- – To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket, 14 mm -3150- .
- • Tightening torque: 25 Nm.



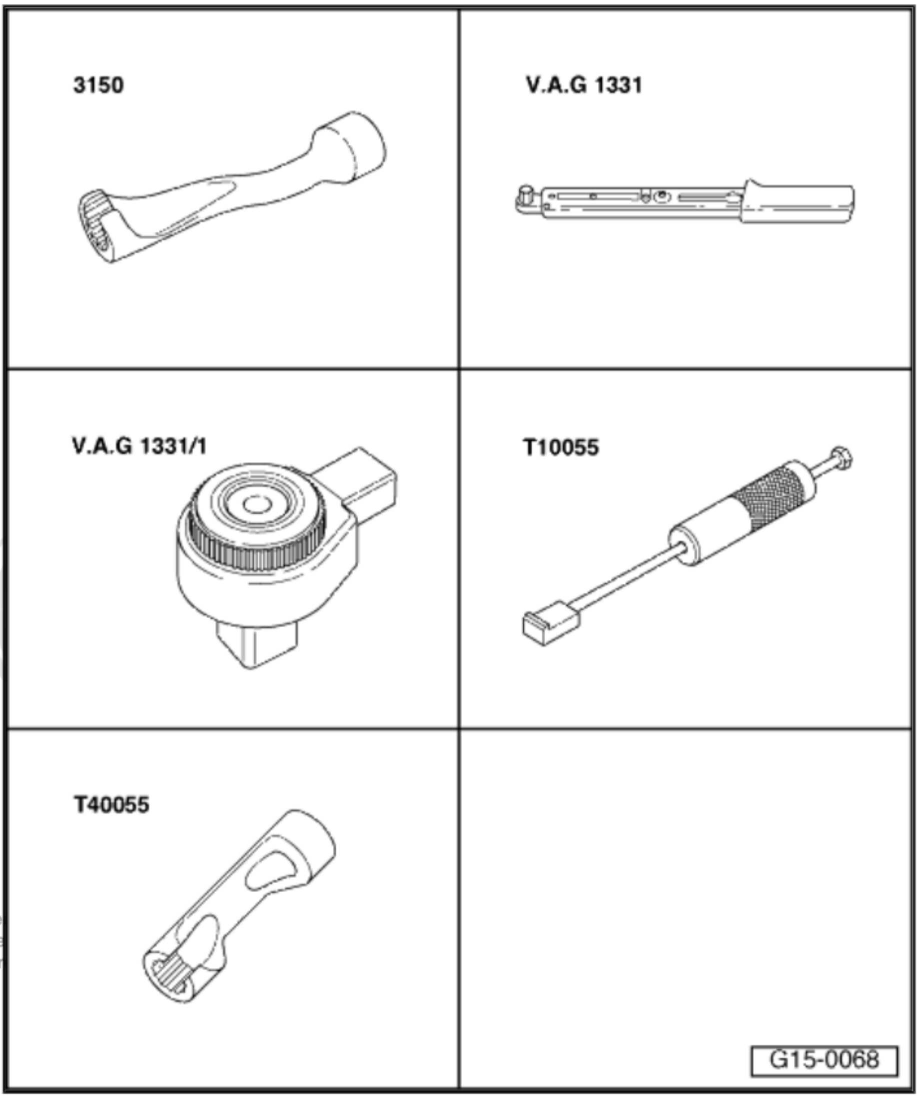
Tightening high-pressure pipes at injectors

- – Tighten union nuts on high-pressure pipes hand-tight initially.
- – Ensure that high-pressure pipes are not under tension.
- – To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket -T40055- .
- • Tightening torque: 25 Nm.

2.3 Removing and installing cylinder head cover

Special tools and workshop equipment required

- Socket, 14 mm -3150-
- Torque wrench -V.A.G 1331-
- Ratchet -V.A.G 1331/1-
- Puller -T10055- with -T10055/1-
- Socket -T40055-



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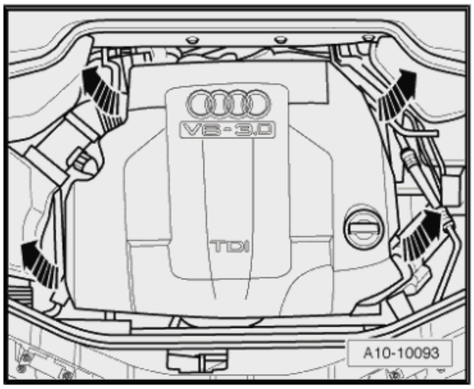
Removing

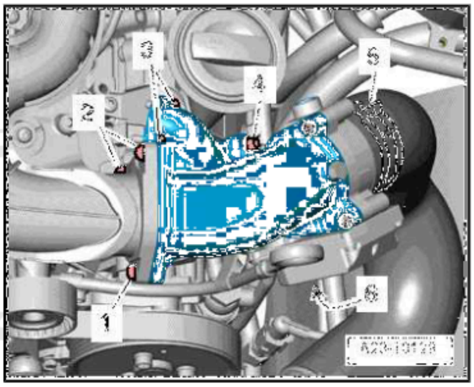
Note

The following description shows the removal and installation of the left cylinder head cover. The procedure for the other side is the same, except that some steps are not required.

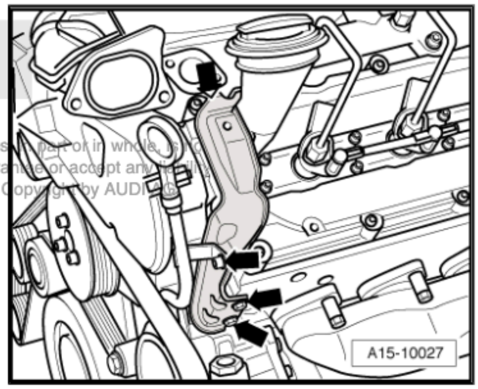
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



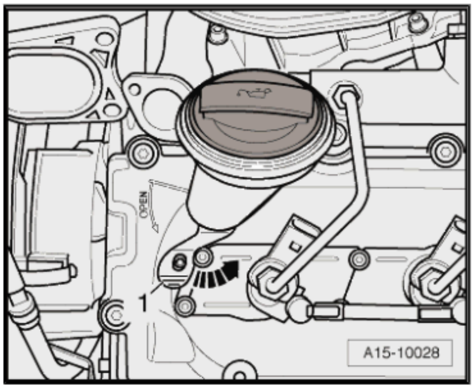
- Disconnect air intake hose -5- from throttle valve module -J338- .
- Unplug electrical connector -6- at throttle valve module -J338- .
- Remove bolts -1 … 4- and take out intake connecting pipe.



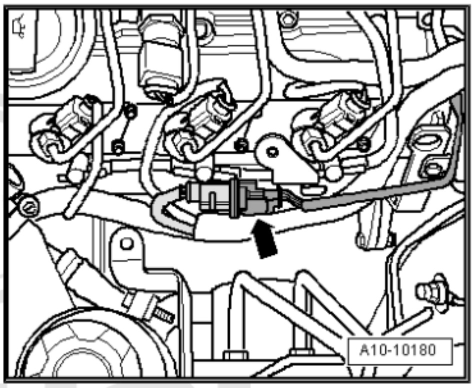
- Unbolt bracket for intake connecting pipe from cylinder head -arrows-.



- Remove oil filler neck. To do so, lift tab -1- and turn oil filler neck anti-clockwise -arrow-.



- Unplug electrical connector -arrow- for Lambda probe -G39- and move wiring clear.



> Caution
>
> *Rules for cleanliness when working on the injection system* *⇒ page 6* .

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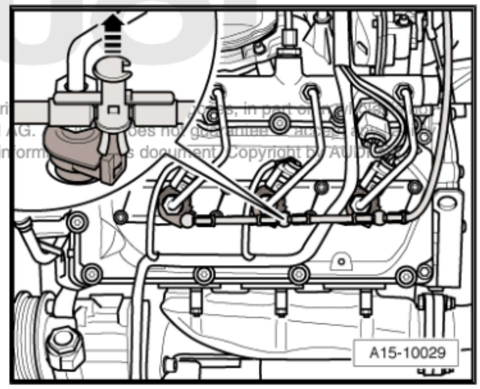
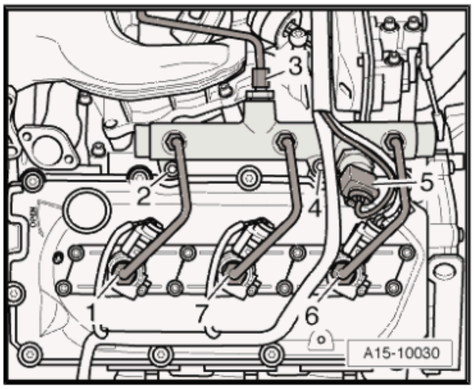
- Pull release pins upwards -arrow- and pull return line connections off injectors.



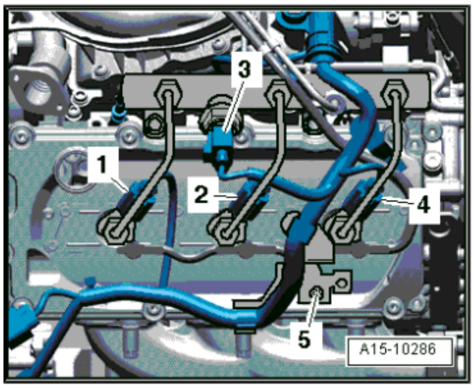
Vehicles up to 08.2005:

- Unplug electrical connectors -5- at rail element and at injectors.
- Move electrical wiring harness at rail element clear.
- Loosen union nuts for injector pipes -1-, -6- and -7- using socket -T40055- .
- Loosen union nut for high-pressure pipe -3- at rail element.
- Unscrew bolts -2- and -4- and detach rail element.

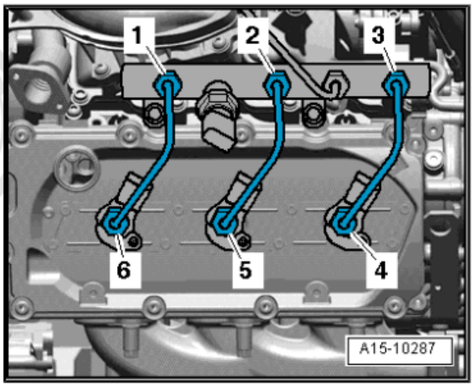


Vehicles from 08.2005 onwards:

- Unbolt bracket -5- for wiring harness at cylinder head cover.
- Unplug electrical connectors -1 ... 4- at rail element and at injectors.
- Move electrical wiring harness clear.

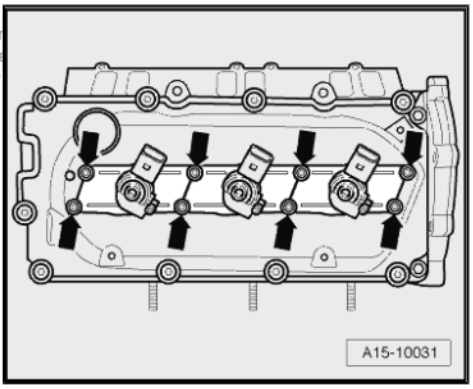


- Mark high-pressure pipes to ensure they are re-connected to the same injectors.
- Loosen union nuts for high-pressure pipes -1 ... 6- using tool insert, AF 19 -V.A.G 1331/5- and socket -T40055- .
- Detach high-pressure pipes.

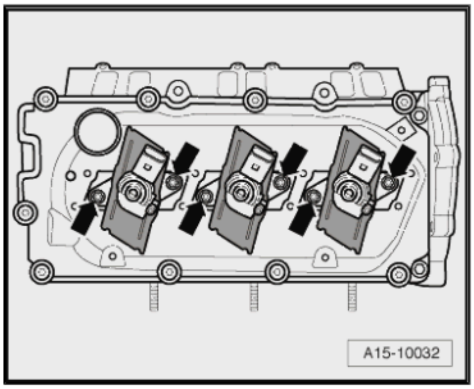


All vehicles:

- Unbolt covers for injectors -arrows-.



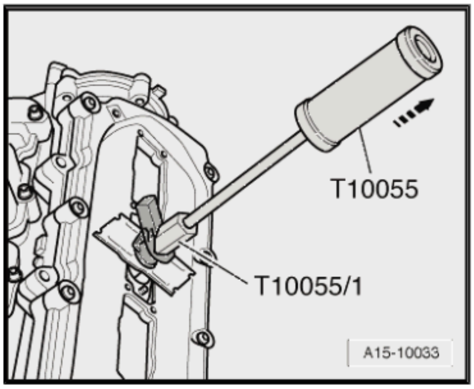
- Pull covers upwards and turn them $^1/_4$ turn (90°).
- Unbolt injectors -arrows-.



- Pull out injectors using puller -T10055- with -T10055/1- .

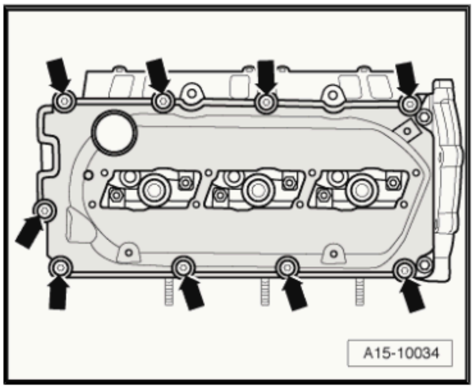
Caution

- *Mark cylinder numbers on injector units.*
- *Used injectors must always be re-installed on the same cylinder.*



– Loosen cylinder head cover bolts -arrows- in diagonal sequence.

– Remove bolts and take off cylinder head cover.



Installing

Installation is carried out in the reverse order; note the following:

Note

- ♦ *Renew cylinder head cover gaskets if damaged.*
- ♦ *Renew gaskets, seals and O-rings.*
- ♦ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ♦ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Tighten bolts for cylinder head cover in diagonal sequence and in stages.

Instructions for installing injectors:

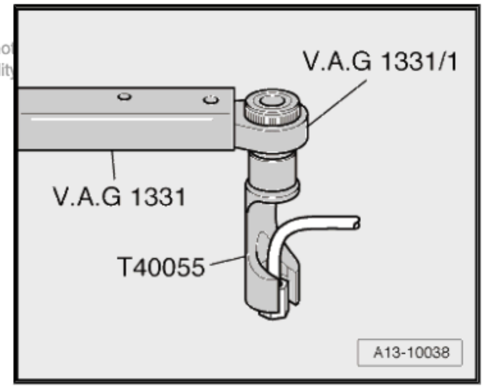
- Before installation, make sure the injectors and their surroundings are clean. If necessary use a clean cloth to wipe out the injector slot, taking care not to cause damage (do not use sharp-edged tools).
- Always install new seals and gaskets. Lubricate all seals and gaskets lightly with engine oil or assembly oil before installing.
- The injectors must be completely undamaged. To remove the old copper seal from the injector, clamp the seal carefully in a vice so that it is just held between the jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.
- When an injector is renewed, also renew the high-pressure pipe and clamping piece at the same time.
- Used injectors and high-pressure pipes may only be re-installed on the same cylinder.

– Install injectors.

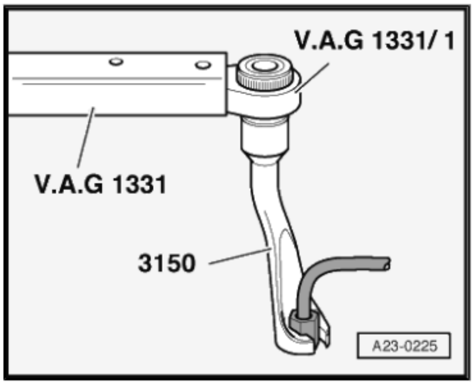
– Tighten union nuts on high-pressure pipes hand-tight initially.

– Ensure that high-pressure pipes are not under tension.

– To tighten unions of high-pressure pipes, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket -T40055- .



- To tighten unions of high-pressure pipes at rail elements, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket, 14 mm -3150- .



- Check fuel system for leaks ⇒ page 6 .

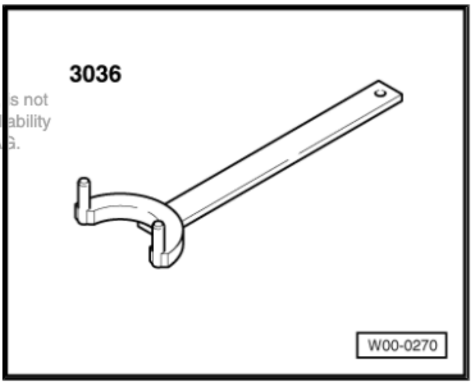
Tightening torques

Component		Nm
Cylinder head cover to cylinder head		9
Injector in cylinder head		9
Cover for injector to cylinder head		5
Rail element to cylinder head		22
High-pressure pipes		25
Bracket for intake connecting pipe to cylinder head		9
Intake connecting pipe to:	Intake manifold	9
	Bracket	9
Hose clips (13 mm wide)		5.5

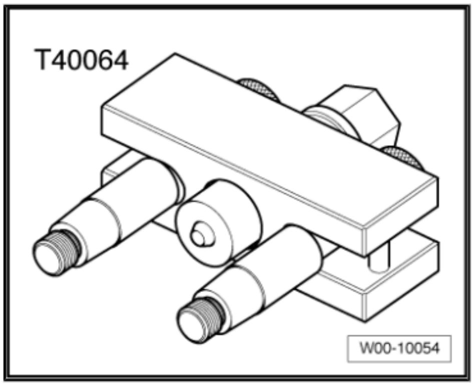
2.4 Removing cylinder head - vehicles up to 08.2005

Special tools and workshop equipment required

- Counterhold tool -3036-



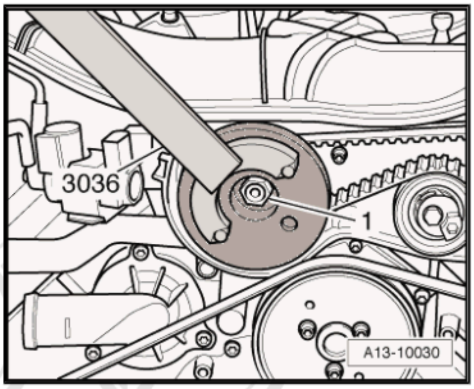
- Puller -T40064-



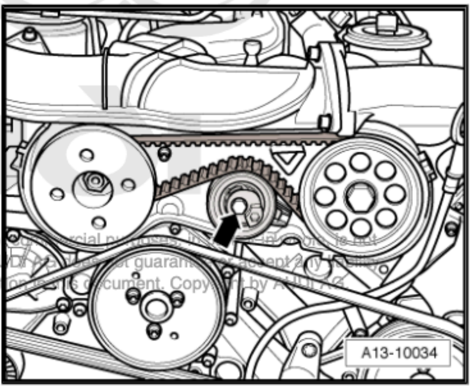
Removing

- Drain off coolant ⇒ page 202 .
- Move lock carrier to service position ⇒ page 43 .
- Remove timing chain from camshaft ⇒ page 88 on relevant cylinder bank.

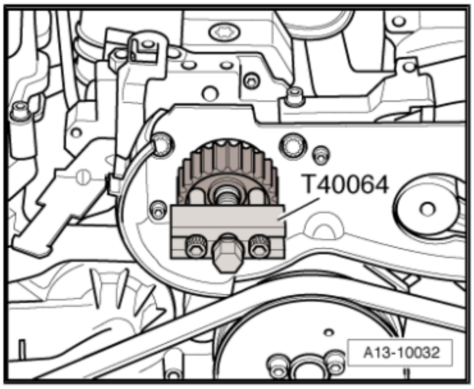
- Remove appropriate intermediate pipe: left-side ⇒ page 292 , right-side ⇒ page 294 .
- Loosen central nut -1- for high-pressure pump shaft using counterhold tool -3036- .
- Remove damper weight.



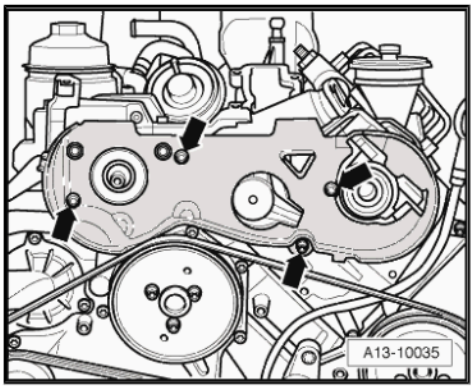
- Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Remove tensioning roller for toothed belt for high-pressure pump -arrow-.



- Use puller -T40064- to pull off belt sprocket for high-pressure pump.

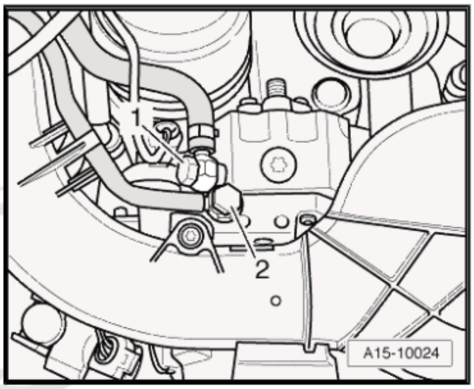


- Unscrew bolts -arrows- and remove toothed belt cover (rear).



Cylinder head (right-side):

– Disconnect fuel supply line -2- and fuel return line -1- from high-pressure pump and move lines clear to the side.



Continuation for both sides:

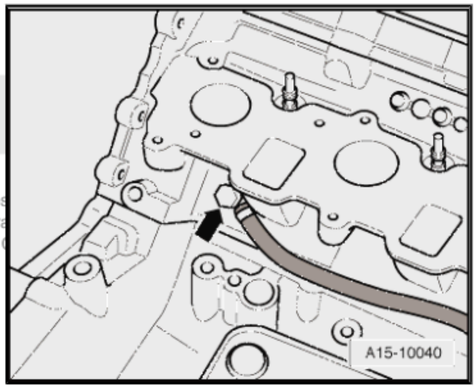
– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

– Remove bottom section of intake manifold (left or right) ⇒ Rep. gr. 23 .

– Remove cylinder head cover (left or right) ⇒ page 127 .

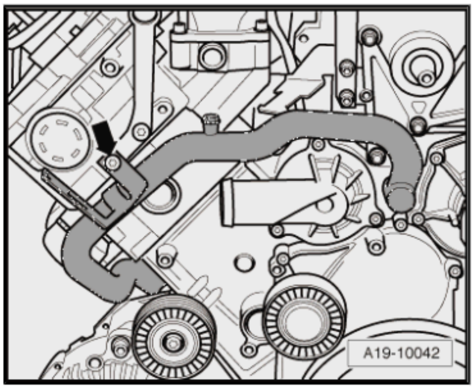
Vehicles up to 10.2004:

– Disconnect coolant line -arrow- (left or right).



Cylinder head (right-side):

– Unbolt coolant pipe (right-side, centre) from cylinder head -arrow-.

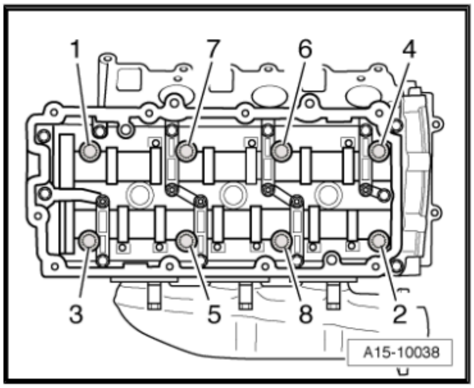


Continuation for both sides:

– Loosen cylinder head bolts in the sequence shown.

– Unscrew bolts completely and take off cylinder head carefully.

– Lay cylinder head aside on a suitable soft surface with the sealing surface facing upwards.



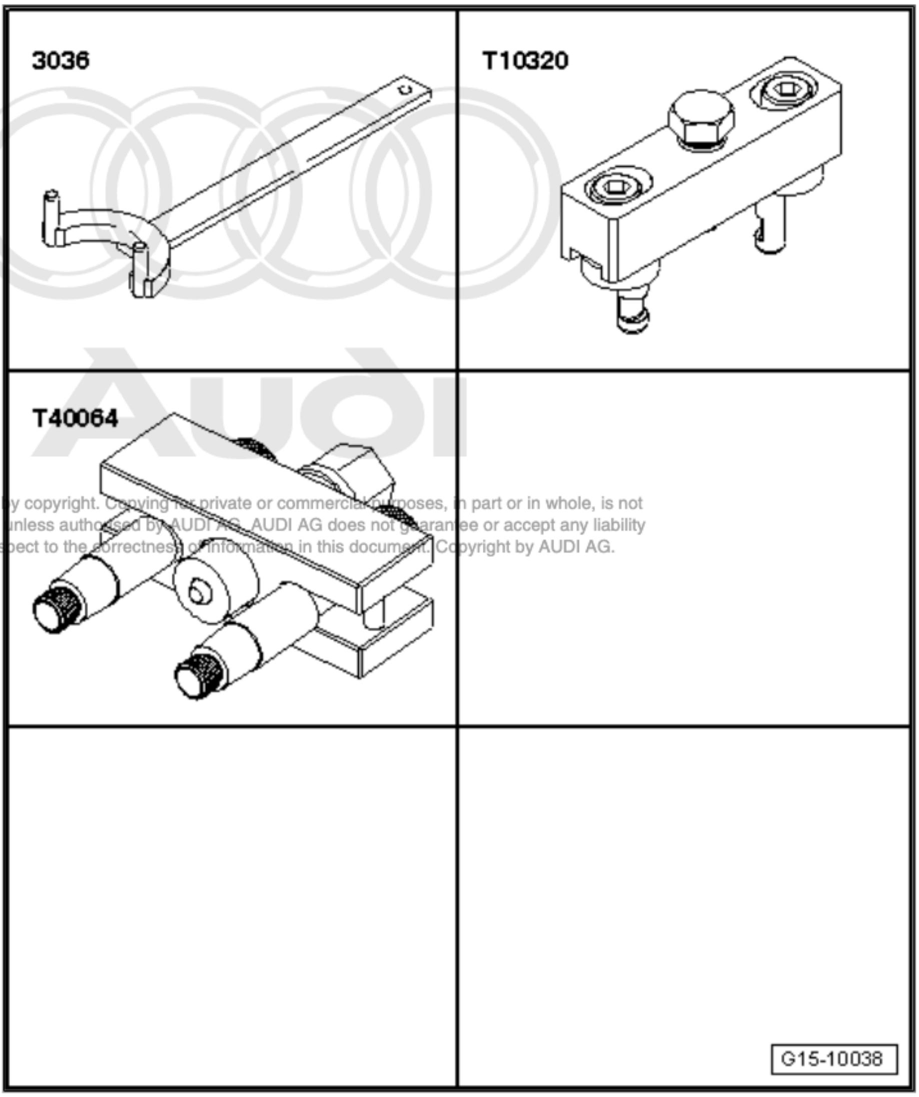
Caution

- *Vehicles with steel glow plugs: After removal, do NOT lay the cylinder head down on the gasket side while the glow plugs are still installed because the glow plugs project slightly beyond the cylinder head gasket surface.*
- *Vehicles with ceramic glow plugs: The ceramic glow plugs fitted in this engine are very easily damaged and project slightly beyond the cylinder head gasket surface, so do NOT lay the cylinder head down on the gasket side when it is removed and while the glow plugs are still installed.*
- *Handling ceramic glow plugs ⇒ page 120 .*

2.5 Removing cylinder head - vehicles from 08.2005 onwards

Special tools and workshop equipment required

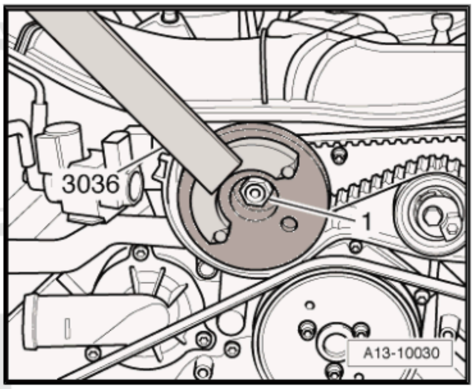
- Counterhold tool -3036-
- Puller -T10320-
- Puller -T40064-



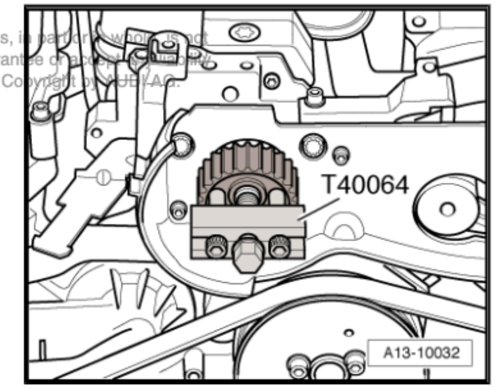
Removing

- Drain off coolant ⇒ page 202 .
- Move lock carrier to service position ⇒ page 43 .
- Remove timing chain from camshaft ⇒ page 88 on relevant cylinder bank.
- Remove appropriate intermediate pipe: left-side ⇒ page 292 , right-side ⇒ page 294 .

- Loosen central nut -1- for high-pressure pump shaft using counterhold tool -3036- .
- Remove damper weight.

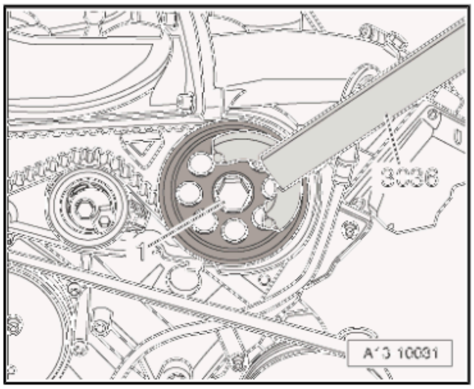


- Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Use puller -T40064- to pull off belt sprocket for high-pressure pump.

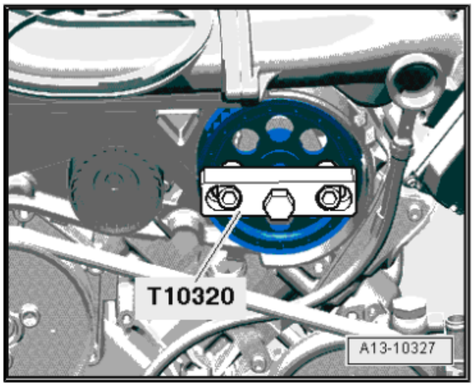


Vehicles from 03.2006 onwards:

- Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool -3036- .

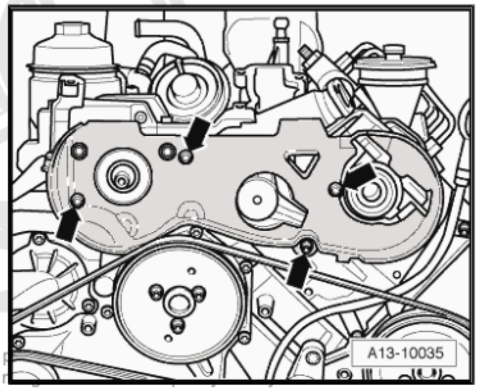


- Use puller -T10320- to pull off toothed belt drive sprocket.



All vehicles:

– Remove bolts -arrows- and detach toothed belt cover (rear).



Cylinder head (right-side):

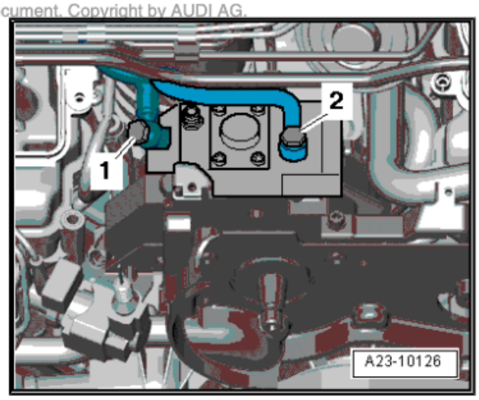
– Disconnect fuel supply line -2- and fuel return line -1- from high-pressure pump and move lines clear to the side.

Continuation for both sides:

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

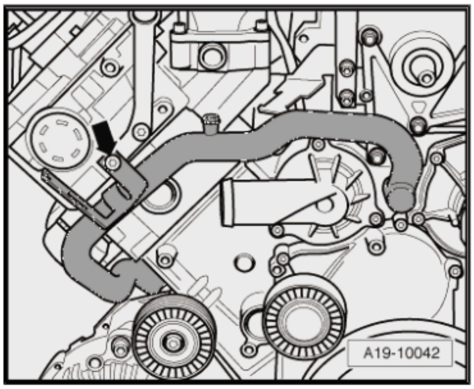
– Remove bottom section of intake manifold (left or right) ⇒ Rep. gr. 23 .

– Remove cylinder head cover (left or right) ⇒ page 127 .



Cylinder head (right-side):

– Unbolt coolant pipe (right-side, centre) from cylinder head -arrow-.

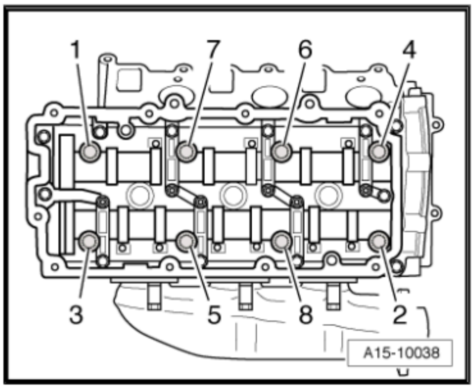


Continuation for both sides:

– Loosen cylinder head bolts in the sequence shown.

– Remove bolts and carefully detach cylinder head.

– Lay cylinder head aside on a suitable soft surface with the sealing surface facing upwards.



Caution

After removal, the cylinder head must not be put down on the gasket side with the glow plugs still installed, because the glow plugs project beyond the gasket surface.

2.6 Installing cylinder head

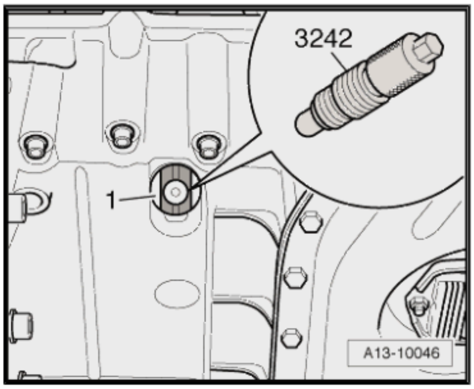
Note

- *The cylinder heads of diesel engines must not be machined.*
- *Renew the cylinder head bolts.*
- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- *If repairing, carefully remove any remaining gasket material from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.*
- *Carefully remove any remaining emery and abrasive material.*
- *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*
- *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- *Handle gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.*
- *Position cylinder head gasket on dowel sleeves. The word -oben- (top) or the Part No. must face towards cylinder head.*
- *The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*
- *When installing an exchange cylinder head with fitted camshafts, oil the contact surfaces between the roller rocker fingers and cams.*
- *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.*

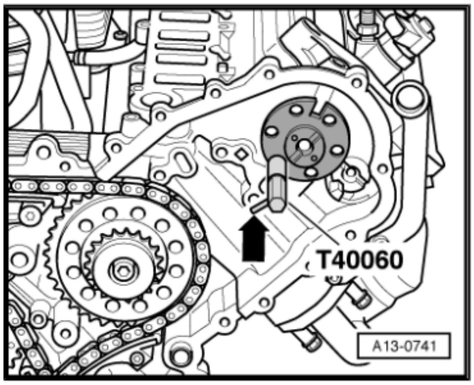
Installation is carried out in the reverse order; note the following:

– Set crankshaft and camshafts to TDC before fitting cylinder head:

- Locking pin -3242- must be screwed in with crankshaft at TDC position -1-.



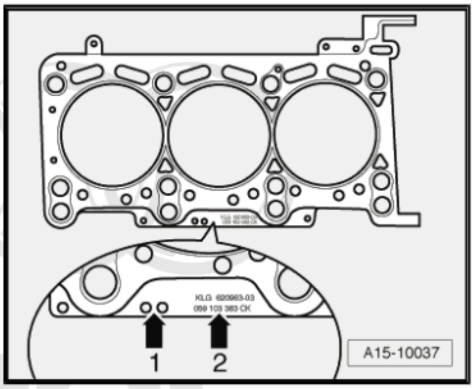
- The camshafts on both cylinder heads must be locked with adjustment pins -T40060- .



– Note identification markings on cylinder head gasket:

1 - Holes

2 - Part No.



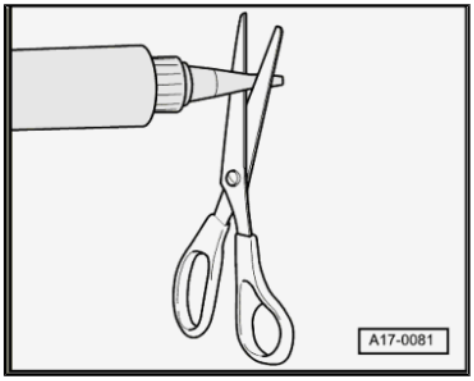
Note

- ◆ *If the cylinder head gasket or cylinder head have been replaced, select the new cylinder head gasket according to the number of holes on the old gasket.*
- ◆ *If parts of the crankshaft drive have been renewed, the new cylinder head gasket must be selected by measuring the piston projection at TDC ⇒ page 117 .*
- ◆ *The gaskets for the left and right cylinder heads have different shapes and cannot be interchanged.*

– Clean surfaces; they must be free of oil and grease.

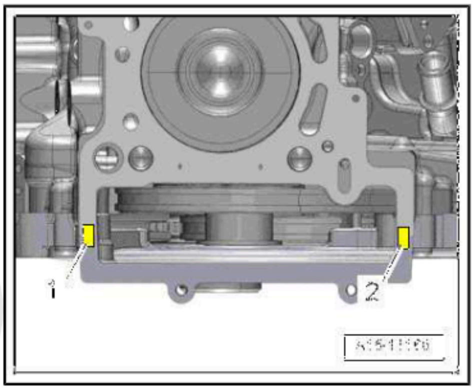
Note

- ◆ *Note the use-by date of the sealant.*
- ◆ *Cut off nozzle of tube at front marking (nozzle ∅ approx. 5 mm).*
- ◆ *After applying sealant, components must be installed and secured within 15 minutes.*



Cylinder head (left-side):

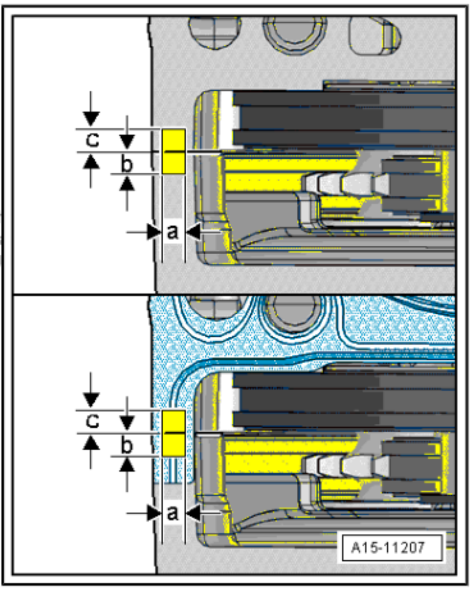
- Apply sealant beads -1- and -2- onto clean sealing surface of cylinder block and timing chain cover (bottom) as illustrated.



- Apply sealant according to dimensions given.

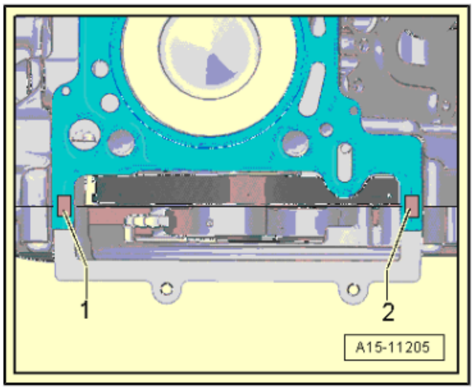
- a = 7 mm
- b = 7 mm
- c = 7 mm

- Place cylinder head gasket in position.

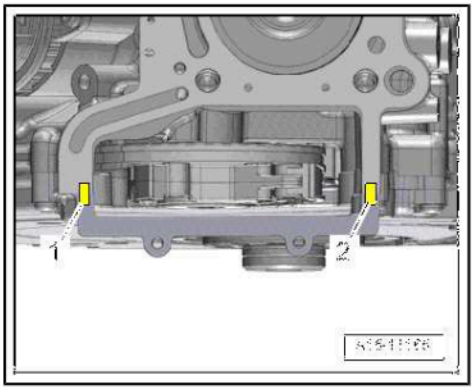


- Apply sealant beads -1- and -2- onto cylinder head gasket as shown in illustration.

Cylinder head (right-side):



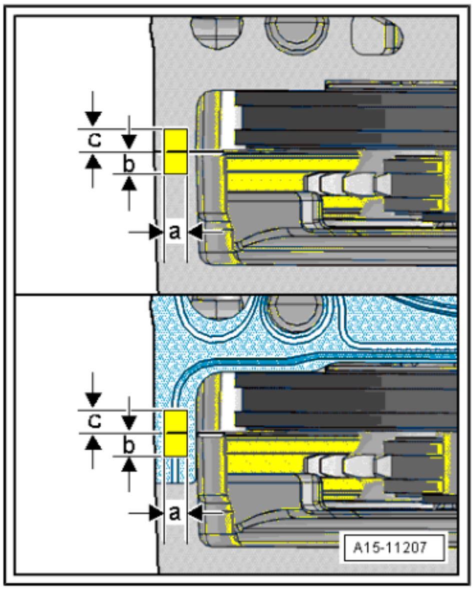
- Apply sealant beads -1- and -2- onto clean sealing surface of cylinder block and timing chain cover (bottom) as illustrated.



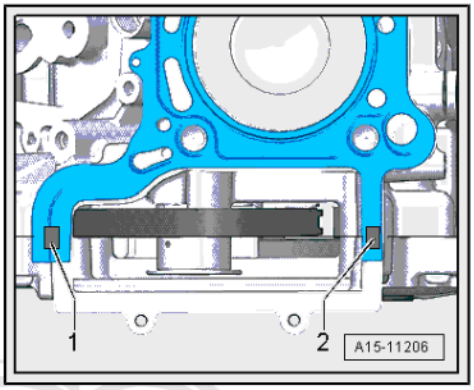
- Apply sealant according to dimensions given.

- a = 7 mm
- b = 7 mm
- c = 7 mm

- Place cylinder head gasket in position.



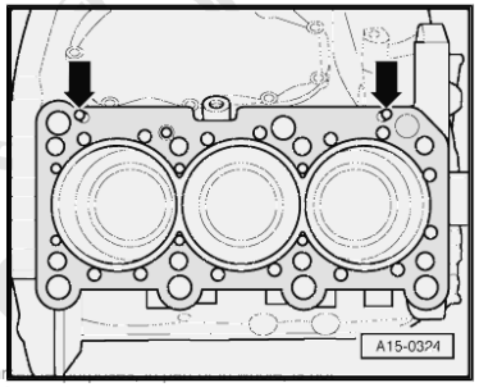
- Apply sealant beads -1- and -2- onto cylinder head gasket as shown in illustration.



Continuation for both sides:

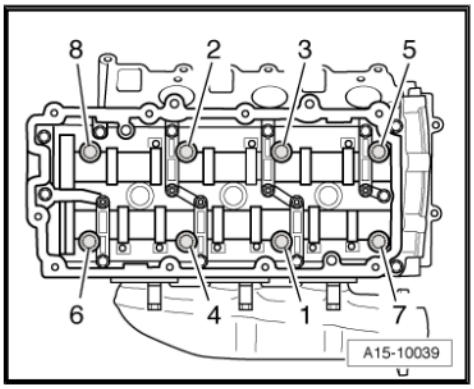
- Pay attention to dowel sleeves -arrows- in cylinder block.
- Check installation position of cylinder head gasket: the word „oben“ (top) or the Part No. should face towards the cylinder head.

- Fit cylinder head.
- Insert new cylinder head bolts and tighten hand-tight.



- Tighten cylinder head bolts as follows in the sequence shown:

1. Tighten with torque wrench to 35 Nm.
2. Tighten with torque wrench to 60 Nm.
3. Turn 90° ($^{1}/_{4}$ turn) further using a rigid wrench.
4. Turn 90° ($^{1}/_{4}$ turn) further using a rigid wrench.



Note

Cylinder head bolts do not have to be torqued down again later after repair work.

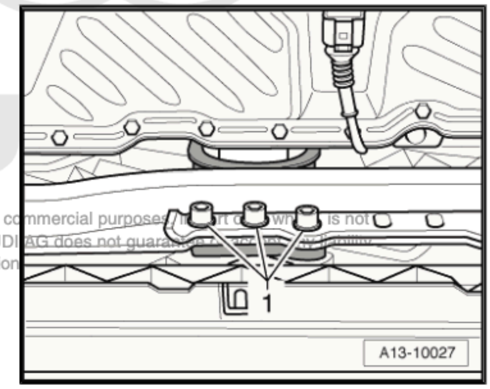
- Install cylinder head cover (left and right) ⇒ page 127 .
- Install bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .
- Install intake manifold (top section) ⇒ Rep. gr. 23 .
- Install camshaft timing chains ⇒ page 93 .

Cylinder head (left-side):

- Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

Continuation for both sides:

- Install appropriate intermediate pipe: left-side ⇒ page 292 , right-side ⇒ page 294 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Change engine oil ⇒ Maintenance ; Booklet 404 .
- Fill cooling system with fresh coolant ⇒ page 204 .
- Check fuel system for leaks ⇒ page 6 .

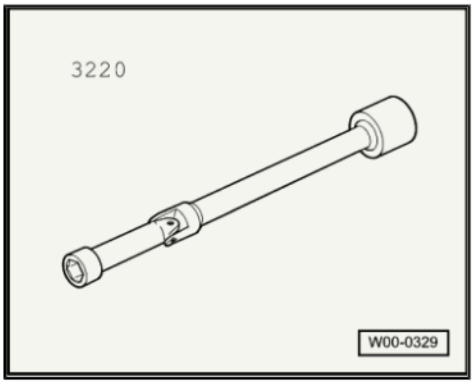
Tightening torques

Component		Nm
Coolant line to cylinder head		15.5
Coolant pipe (right-side, centre) to cylinder head		9
Toothed belt cover (rear) to engine		9
Fuel supply and return lines to high-pressure pump		25
Stop for torque reaction support		28
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

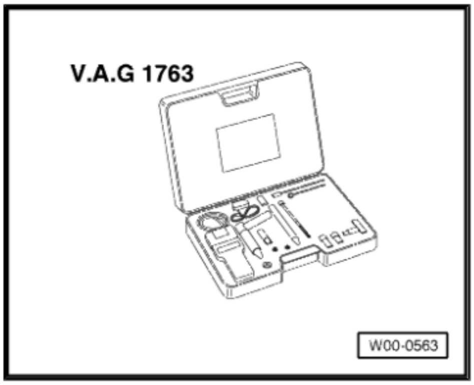
2.7 Checking compression

Special tools and workshop equipment required

- U/J extension and socket, 10 mm -3220-



- Compression tester -V.A.G 1763- with adapter -V.A.G 1763/8-

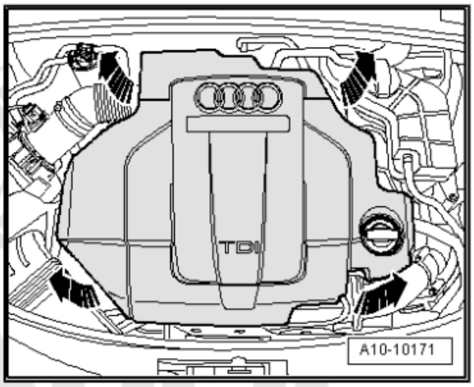


Procedure

- Engine oil temperature approx. 80 °C
- Battery voltage at least 12.5 V.

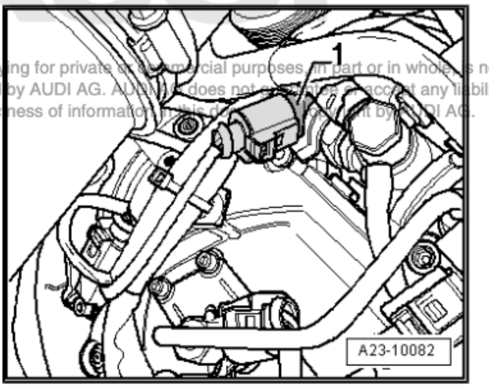
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

– Detach electrical connectors at glow plugs.



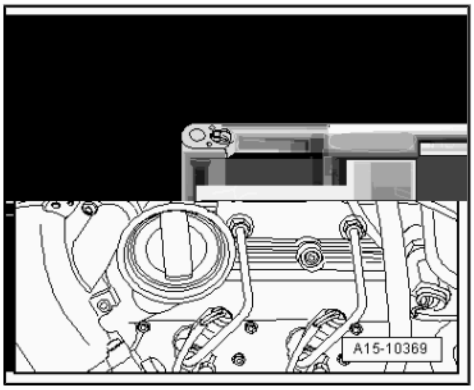
– Unplug electrical connector at fuel pressure regulating valve -N276- -item 1- at right-side fuel rail (cylinder bank 1).

– Briefly start engine to relieve fuel pressure in rail.

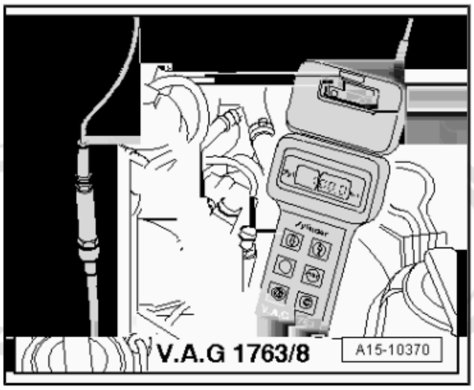


Caution

It is very important to observe all notes on removing the glow plugs ⇒ Rep. gr. 28 .



- Remove all glow plugs ⇒ Rep. gr. 28 .



- Screw in adapter -V.A.G 1763/8- in place of glow plugs and connect compression tester -V.A.G 1763- .

Note

Using the compression tester ⇒ Operating instructions .

- Have a 2nd mechanic operate starter until tester shows no further pressure increase.

Compression pressure	bar
When new	28 … 33
Wear limit	21
Difference between cylinders	5 (maximum)

Assembly is carried out in the reverse order; note the following:

- Install glow plugs ⇒ Rep. gr. 28 .
- When finished, interrogate and erase fault memory for engine control unit, as faults are stored when connectors are unplugged ⇒ Vehicle diagnostic tester.

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3 Servicing valve gear

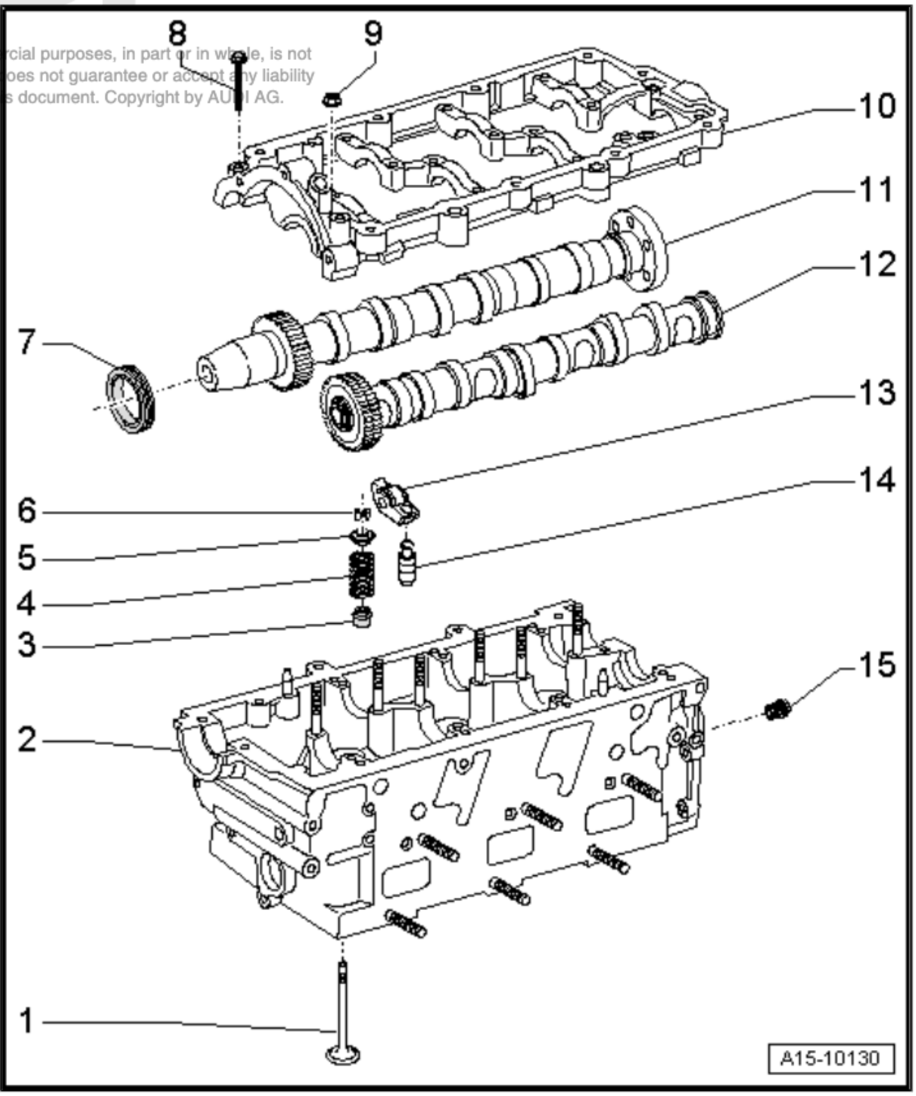
Note

- *After installing camshafts, wait for approx. 30 minutes before starting engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.*

3.1 Valve gear - exploded view

Note

The diagram shows the cylinder head on cylinder bank 2 (left-side).



1 - Valve
- ☐ Do not machine, only grinding-in is permitted
- ☐ Mark installation position for re-installation
- ☐ Valve dimensions ⇒ page 176
- ☐ Checking valve guides ⇒ page 176

2 - Cylinder head
- ☐ See note ⇒ page 145
- ☐ Checking valve guides ⇒ page 176
- ☐ Machining valve seats ⇒ page 176

3 - Valve stem oil seal
- ☐ Renewing: with cylinder head installed ⇒ page 167 , with cylinder head removed ⇒ page 171

4 - Valve spring

5 - Valve spring plate

6 - Valve cotters

7 - Camshaft oil seal
- ☐ Renewing ⇒ page 148

8 - Bolt
- ☐ Retaining frame on cylinder head (left-side) - tightening torque and sequence ⇒ page 146
- ☐ Retaining frame on cylinder head (right-side) - tightening torque and sequence ⇒ page 147

9 - Nut
- ☐ Retaining frame on cylinder head (left-side) - tightening torque and sequence ⇒ page 146

- ☐ Retaining frame on cylinder head (right-side) - tightening torque and sequence ⇒ page 147

10 - Retaining frame

- ☐ With integrated camshaft bearings
- ☐ Removing and installing: cylinder head (left-side) ⇒ page 154 , cylinder head (right-side) ⇒ page 161

11 - Inlet camshaft

- ☐ Removing and installing: cylinder head (left-side) ⇒ page 154 , cylinder head (right-side) ⇒ page 161
- ☐ Checking axial clearance ⇒ page 147
- ☐ Check radial clearance with Plastigage (roller rocker fingers removed)
- ☐ Radial clearance (new): 0.035 ... 0.085 mm
- ☐ Radial clearance: wear limit: 0.1 mm
- ☐ Runout: max. 0.01 mm

12 - Exhaust camshaft

- ☐ Removing and installing: cylinder head (left-side) ⇒ page 154 , cylinder head (right-side) ⇒ page 161
- ☐ Checking axial clearance ⇒ page 147
- ☐ Check radial clearance with Plastigage (roller rocker fingers removed)
- ☐ Radial clearance (new): 0.035 ... 0.085 mm
- ☐ Radial clearance: wear limit: 0.1 mm
- ☐ Runout: max. 0.01 mm

13 - Roller rocker finger

- ☐ Mark installation position with a coloured pen
- ☐ Do not interchange
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surfaces before installing

14 - Hydraulic valve compensation element

- ☐ Mark installation position with a coloured pen
- ☐ Checking ⇒ page 174
- ☐ Lubricate contact surfaces before installing

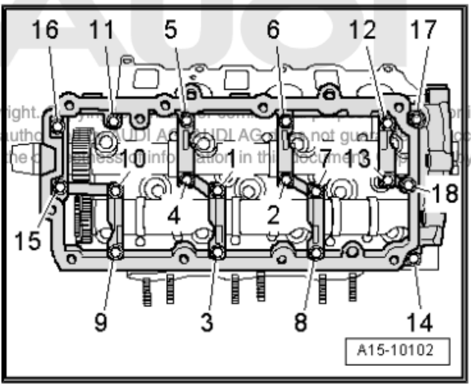
15 - Pressure limiting valve, 25 Nm

- ☐ Not applicable to more recent versions

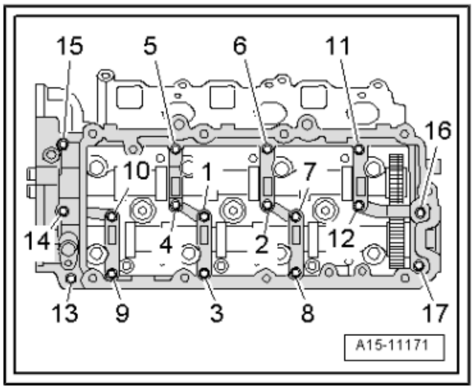
Retaining frame on cylinder head (left-side) - tightening torque and sequence

– Tighten bolts and nuts in 2 stages in the sequence shown:

Stage	Bolts/nuts	Tightening torque
1.	-1 … 18-	Screw in by hand until they make contact • The retaining frame should make contact with the cylinder head over the full surface
2.	-1 … 18-	9 Nm



Retaining frame on cylinder head (right-side) - tightening torque and sequence



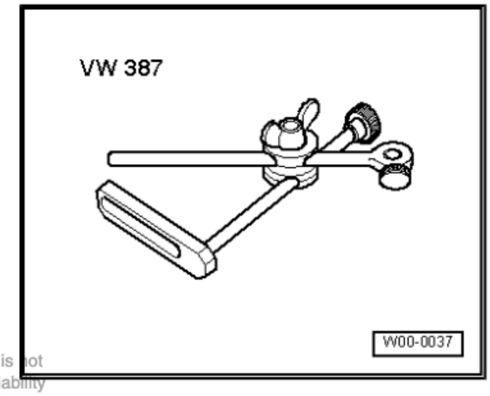
– Tighten bolts and nuts in 2 stages in the sequence shown:

Stage	Bolts/nuts	Tightening torque
1.	-1 … 17-	Screw in nuts by hand until they make contact • The retaining frame should make contact with the cylinder head over the full surface
2.	-1 … 17-	9 Nm

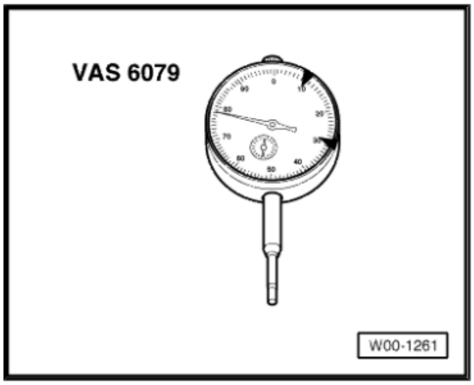
3.2 Checking axial clearance of camshafts

Special tools and workshop equipment required

- ♦ Universal dial gauge bracket -VW 387-

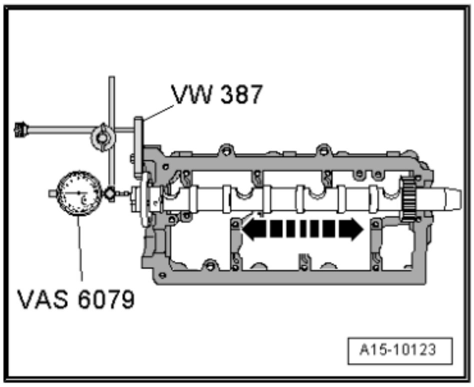


- ♦ Dial gauge -VAS 6079-



Procedure

– Perform measurement with retaining frame removed.

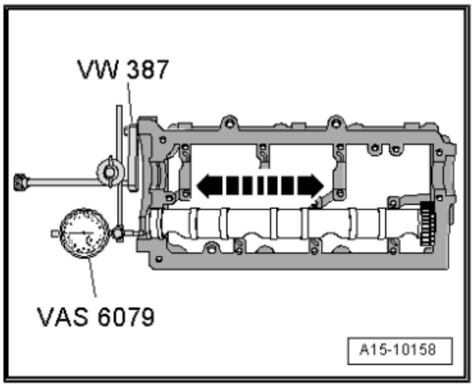


Inlet camshaft

- Specification: 0.03 … 0.08 mm.
- Wear limit: 0.12 mm.

Exhaust camshaft

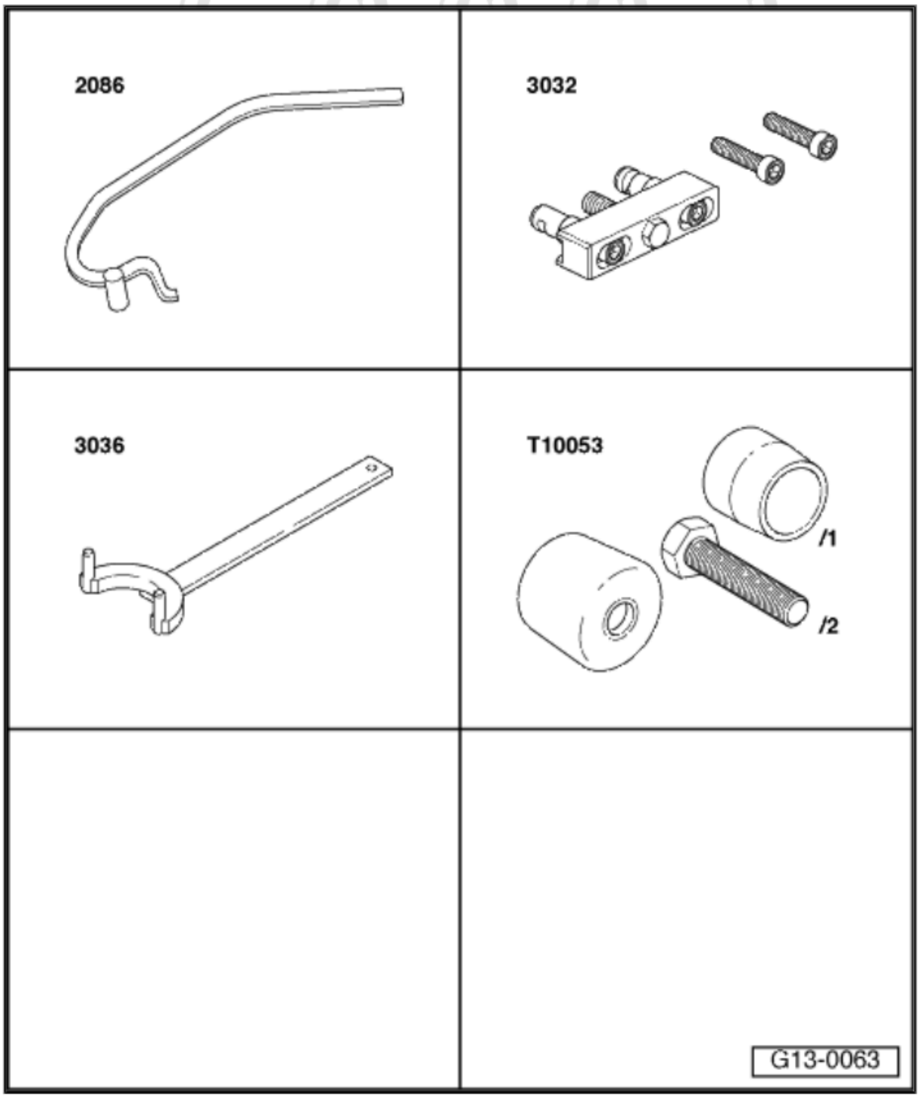
- Specification: 0.03 … 0.08 mm.
- Wear limit: 0.12 mm.



3.3 Renewing camshaft oil seal (toothed belt drive sprocket with M14 securing bolt)

Special tools and workshop equipment required

- Extractor tool -2086-
- Puller -3032-
- Counterhold tool -3036-
- Assembly tool -T10053-

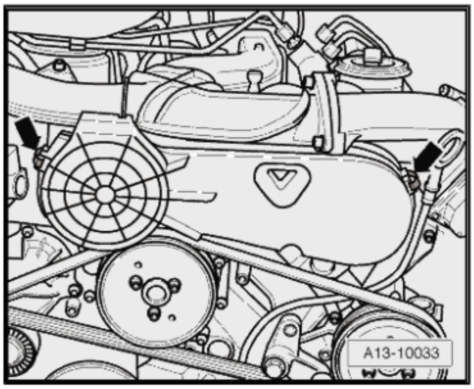


Procedure

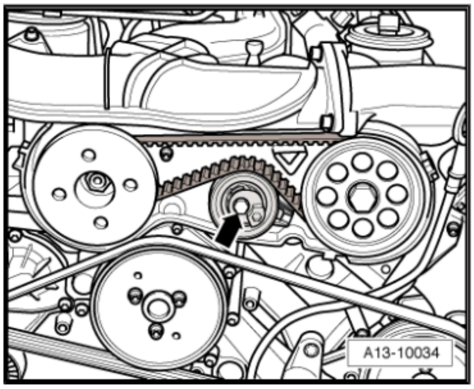
– Move lock carrier to service position ⇒ page 43 .

– Loosen clamps -arrows-.

– Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.



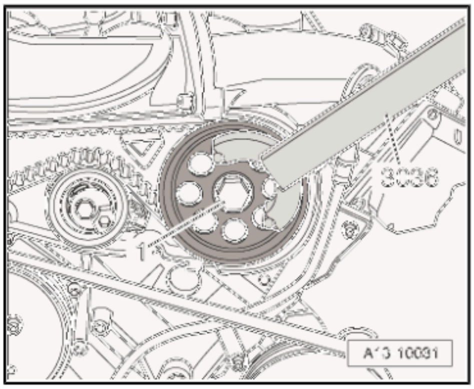
– Loosen bolt -arrow- for toothed belt tensioning roller approx. 2 turns.



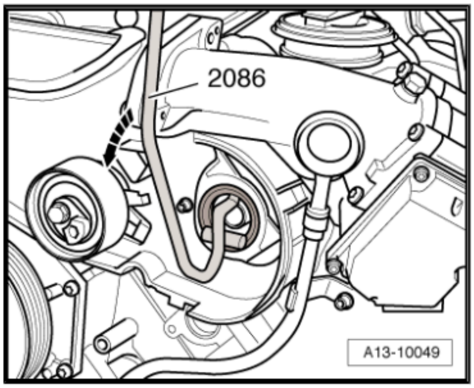
– Loosen central bolt -1- for drive sprocket for high-pressure pump approx. 2 turns using counterhold -3036- .

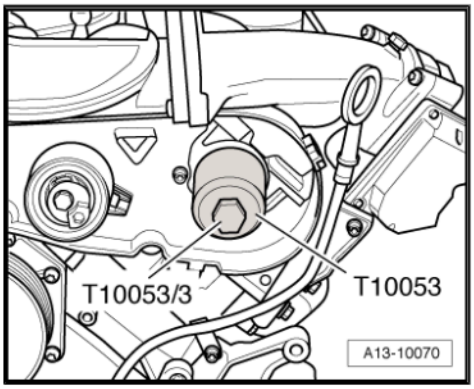
– Use puller -3032- to pull off drive sprocket for high-pressure pump.

– Take off drive sprocket together with toothed belt.



– Pry out oil seal using oil seal extractor hook -2086- .

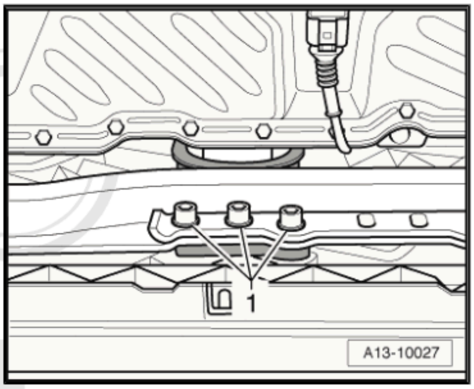




- Clean contact surface and sealing surface.
- Press in oil seal as far as stop using press sleeve from -T10053- and bolt -T10053/3- .

Installation is carried out in the reverse order; note the following:

- Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .

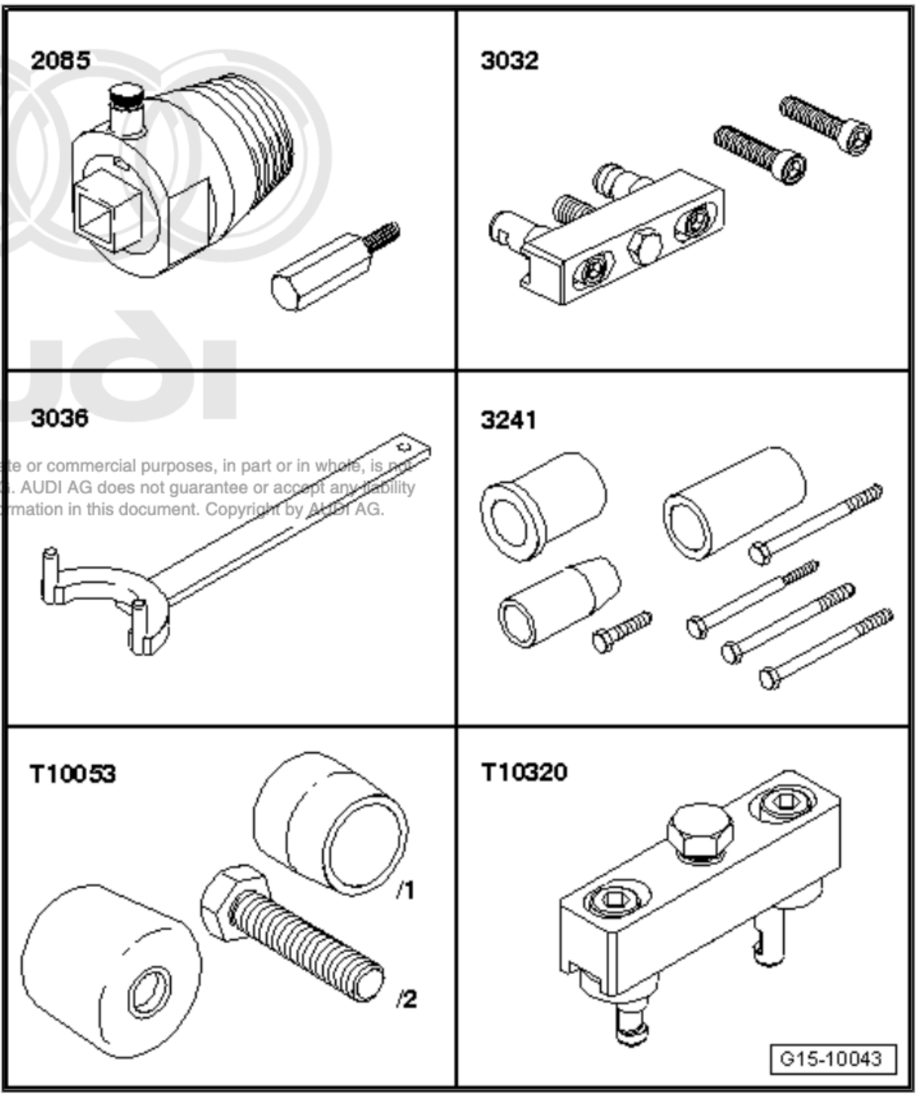
Tightening torques

Component		Nm
Torque reaction support bracket to air pipe (bottom)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

3.4 Renewing camshaft oil seal (toothed belt drive sprocket with M10 securing bolt)

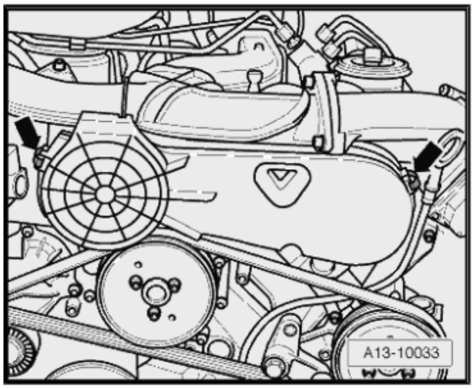
Special tools and workshop equipment required

- ♦ Oil seal extractor -2085-
- ♦ Puller -3032- for vehicles up to 03.2006
- ♦ Counterhold tool -3036-
- ♦ Hexagon bolt M10 x 1.25 x 40, (from fitting sleeves -3241-)
- ♦ Assembly tool -T10053-
- ♦ Puller -T10320- for vehicles from 03.2006 onwards

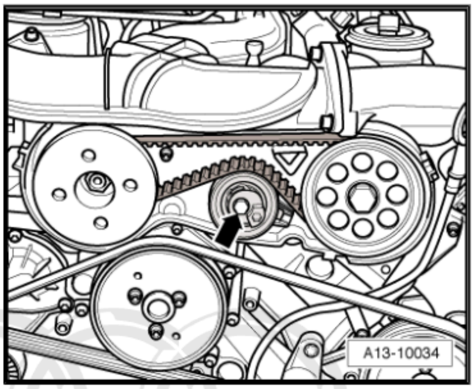


Procedure

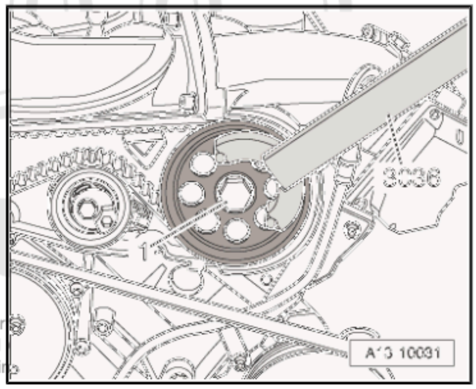
- – Remove intake manifold (top section) ⇒ Rep. gr. 23 .
- – Loosen clamps -arrows-.
- – Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.



- Loosen bolt -arrow- for tensioning roller approx. 2 turns.

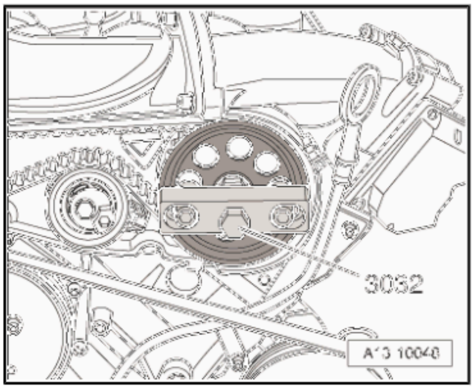


- Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool -3036- .



Vehicles up to 03.2006:

- Use puller -3032- to pull off toothed belt drive sprocket.

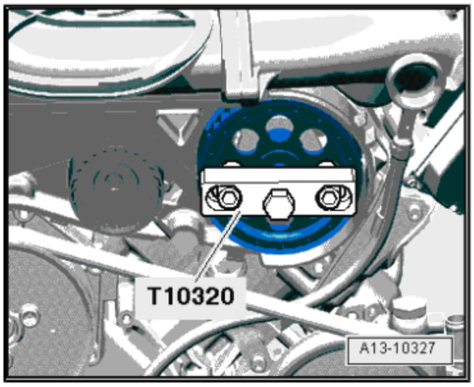


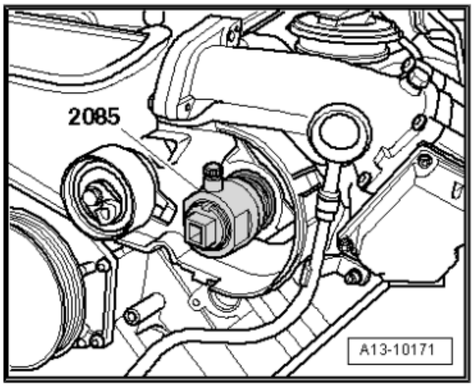
Vehicles from 03.2006 onwards:

- Use puller -T10320- to pull off toothed belt drive sprocket.

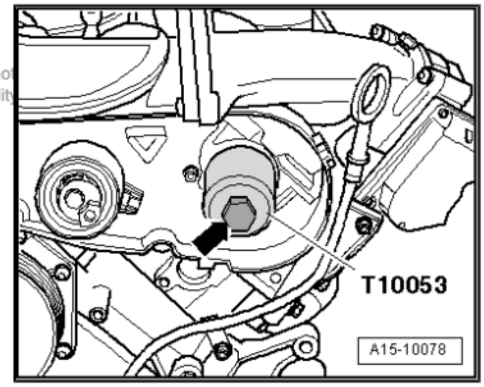
All vehicles:

- Take off toothed belt drive sprocket together with toothed belt.





- Unscrew inner section of oil seal extractor -2085- three turns out of outer section and lock inner section with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove seal.
- Clean running surface and sealing surface.



- Press in new oil seal as far as stop using press sleeve from -T10053- and hexagon bolt M10 x 1.25 x 40 -arrow-, (from fitting sleeves -3241-).

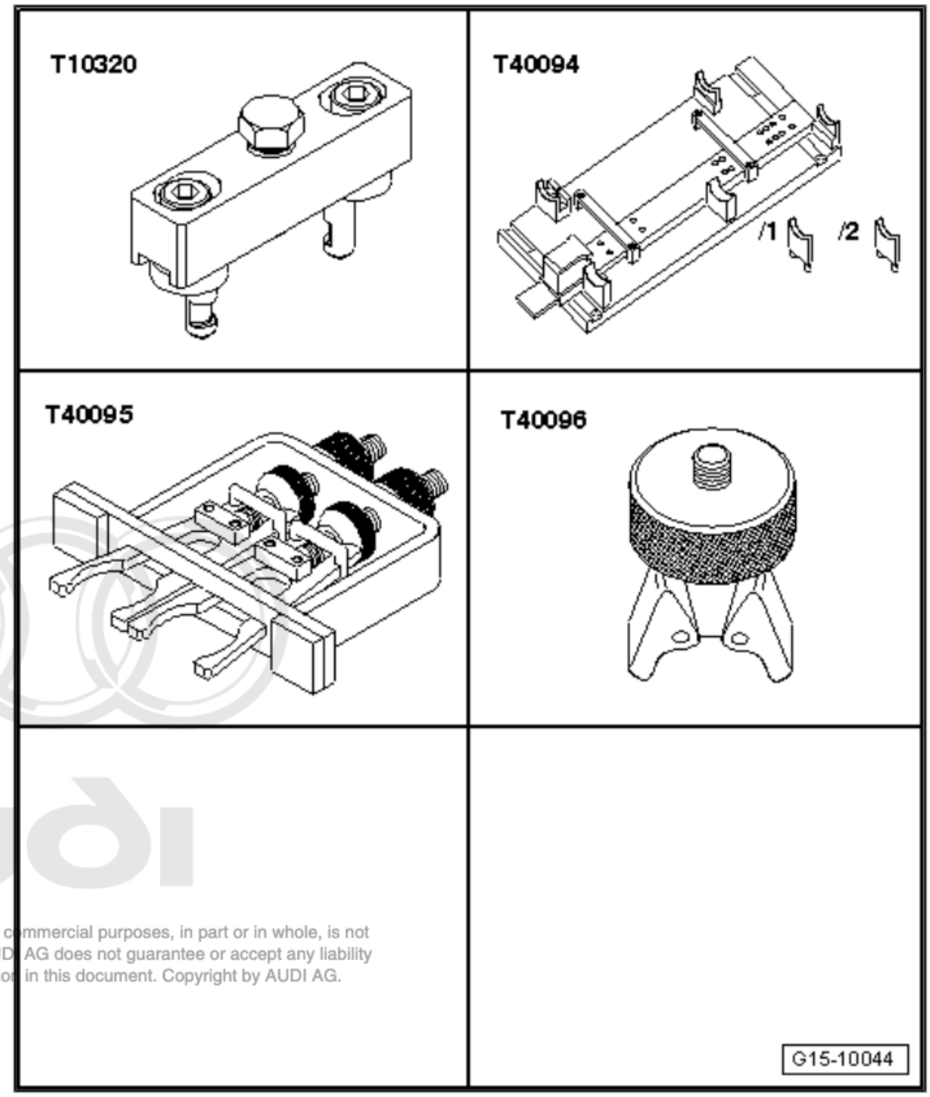
Installation is carried out in the reverse order; note the following:

- Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Install intake manifold (top section) ⇒ Rep. gr. 23 .

3.5 Removing and installing camshafts - cylinder head (left-side)

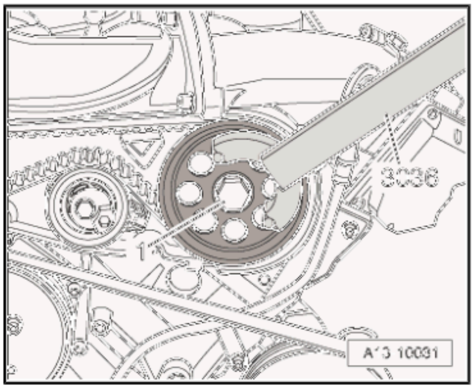
Special tools and workshop equipment required

- Puller -T10320- for vehicles from 03.2006 onwards
- Camshaft fitting tool -T40094-
- Camshaft fitting tool -T40095-
- Camshaft fitting tool -T40096-
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Parts catalogue



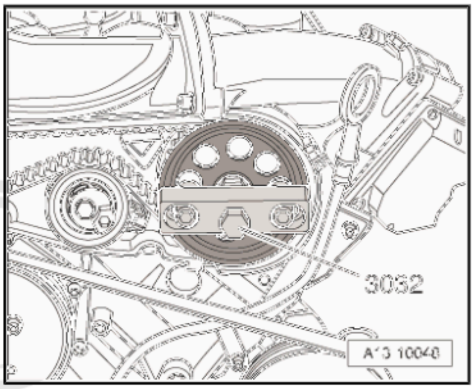
Removing

- Remove timing chain from camshaft ⇒ page 88 on relevant cylinder bank.
- Remove intake manifold (top section) ⇒ Rep. gr. 23 .
- Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool -3036- .

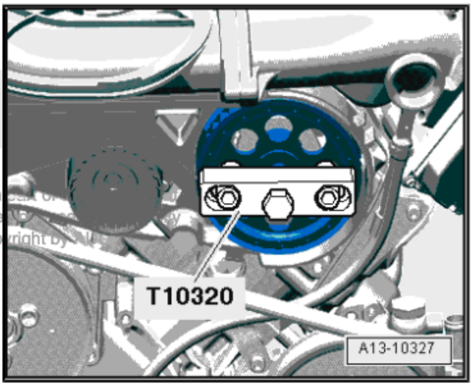


Pulling off toothed belt drive sprocket (depending on vehicle version)

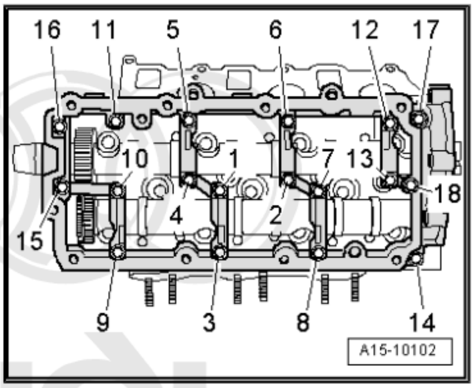
- Use puller -3032- to pull off toothed belt drive sprocket.



- Use puller -T10320- to pull off toothed belt drive sprocket.
- Remove cylinder head cover (left-side) ⇒ page 127 .



- Unscrew retaining frame bolts and nuts in the sequence -18 ... 1-.



Note

Make sure you do not damage roller rocker fingers and compensation elements when removing camshafts.

- Carefully remove retaining frame and camshafts.

Installing

Caution

The camshafts MUST be installed using the camshaft fitting tool -T40094- as described in the following, as the thrust bearings in the retaining frame would otherwise be destroyed. The cylinder head would then have to be renewed.

WARNING

Wear safety goggles.

- Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.

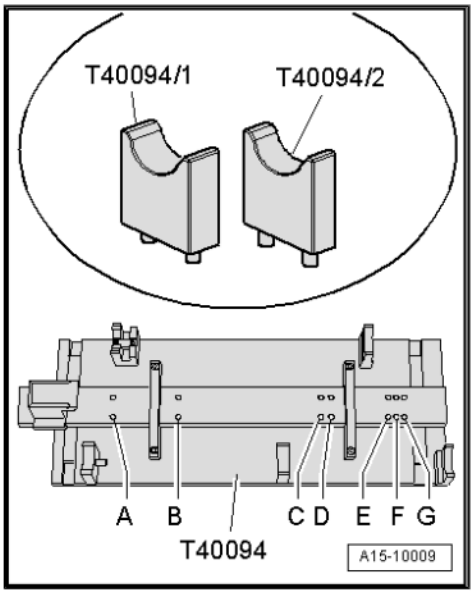
Caution

Make sure that no sealant residue gets into the cylinder head or the bearings.

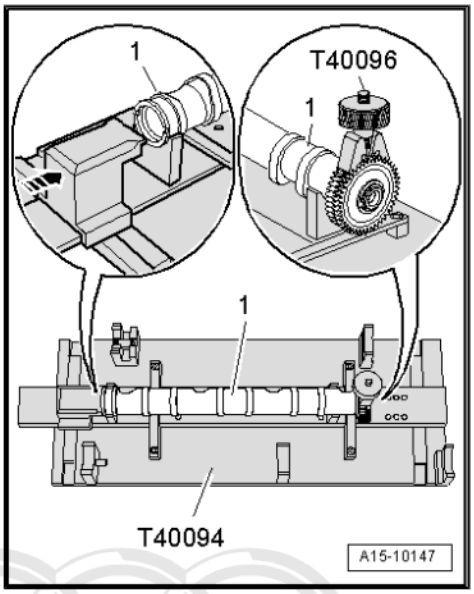
- Clean sealing surfaces; they must be free of oil and grease.
- Lubricate running surfaces of camshafts.

Set up camshaft fitting tool -T40094- as follows:

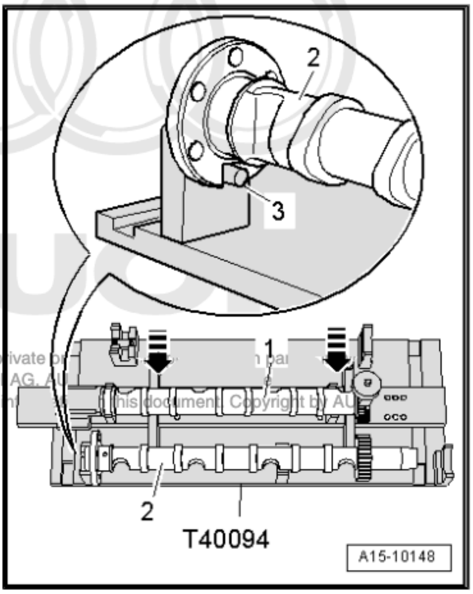
- Insert support -T40094/2- in position -A-.
- Insert support -T40094/1- in position -D-.



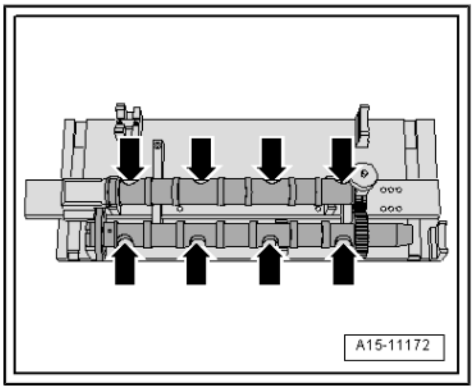
- – Place exhaust camshaft -1- in supports -T40094/1- and -T40094/2- .
- – Turn exhaust camshaft in such a way that it can be locked in „TDC“ position using locking device -arrow-.
- – Place camshaft fitting tool -T40096- on teeth of exhaust camshaft in such a way that the two arms of the tool engage on the two halves of the gear (one in each half, as shown in illustration).
- – Tighten the clamping tool using the knurled wheel so that the faces of the gear teeth are in alignment.



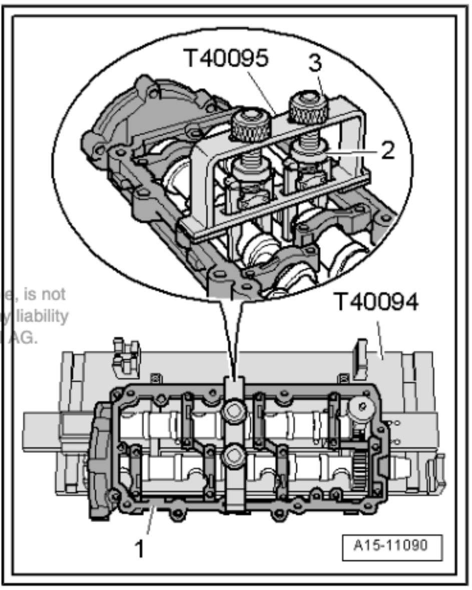
- – Place inlet camshaft -2- in camshaft fitting tool -T40094- .
- • The locating pin -3- must engage in the slot on the inlet camshaft.
- – Slide exhaust camshaft -1- towards inlet camshaft -arrows- until gear teeth engage.



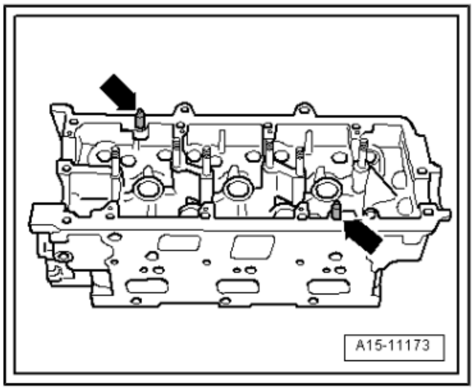
- – Check that camshafts are in correct position:
- • Recesses -arrows- on both camshafts must point outwards.



- Fit retaining frame -1- on both camshafts.
- All camshaft bearings must be seated on the camshafts.
- Attach camshaft fitting tool -T40095- to camshafts (align arms of bracket as required and tighten knurled nuts -2-).
- Apply tension to camshafts by tightening the knurled nuts -3- upwards.



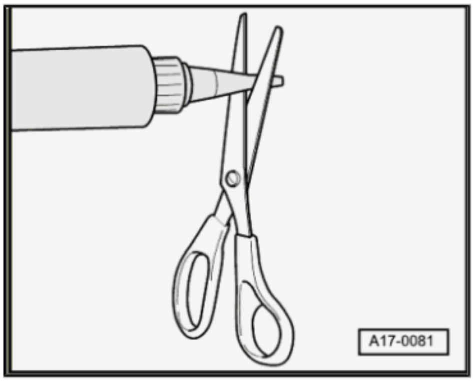
- Check if dowel pins -arrows- are fitted in cylinder head. Install missing dowel pins.



Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle ∅ approx. 1.5 mm).



Note

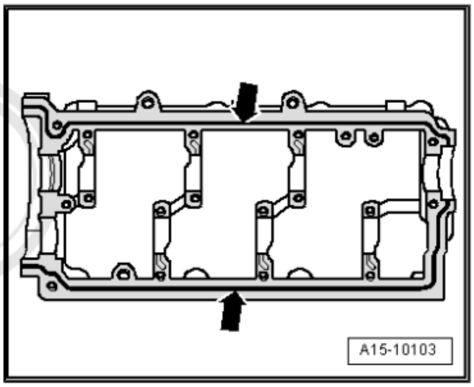
For illustration purposes, the retaining frame is shown without the camshafts.

– Turn retaining frame upside down.

Caution

Make sure lubrication system is not clogged by excess sealant.

- *The sealant beads must not be thicker than specified.*



– Apply beads of sealant -arrows- onto clean sealing surfaces of retaining frame as shown in illustration.

- The grooves on the sealing surface must be completely filled with sealant.
- The beads of sealant must project 1.5 … 2.0 mm above the sealing surface.

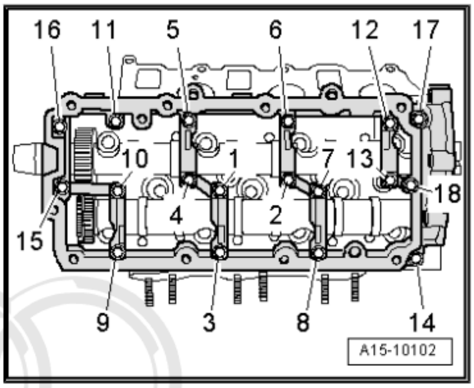
Note

The retaining frame must be installed within 5 minutes after applying the sealant.

Caution

Risk of damage to engine.

- *Ensure that all roller rocker fingers contact the valve ends and compensation elements correctly.*



– Fit retaining frame together with both camshafts and camshaft fitting tool -T40095- onto cylinder head.

– Tighten bolts for retaining frame ⇒ page 146 .

– Remove camshaft fitting tool -T40095- and -T40096- .

Remaining installation steps are carried out in reverse sequence; note the following:

Note

♦ *After installing camshafts, wait for approx. 30 minutes before starting engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*

♦ *After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.*

– Install cylinder head cover (left-side) ⇒ page 127 .

– Renew camshaft oil seal ⇒ „3.3 Renewing camshaft oil seal (toothed belt drive sprocket with M14 securing bolt)“, page 148 or ⇒ „3.4 Renewing camshaft oil seal (toothed belt drive sprocket with M10 securing bolt)“, page 151 .

– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

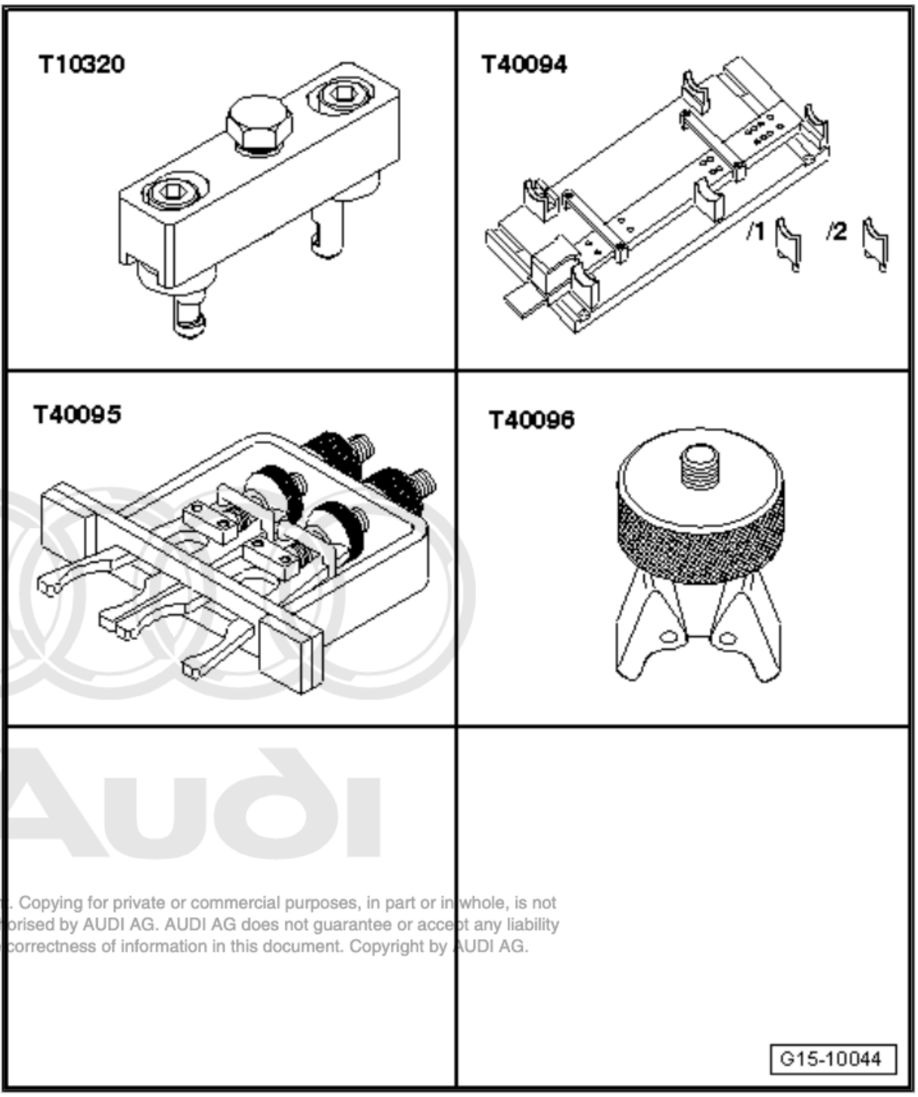
– Install intake manifold (top section) ⇒ Rep. gr. 23 .

– Install camshaft timing chains ⇒ page 84 .

3.6 Removing and installing camshafts - cylinder head (right-side)

Special tools and workshop equipment required

- Puller -T10320- for vehicles from 03.2006 onwards
- Camshaft fitting tool -T40094-
- Camshaft fitting tool -T40095-
- Camshaft fitting tool -T40096-
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Parts catalogue

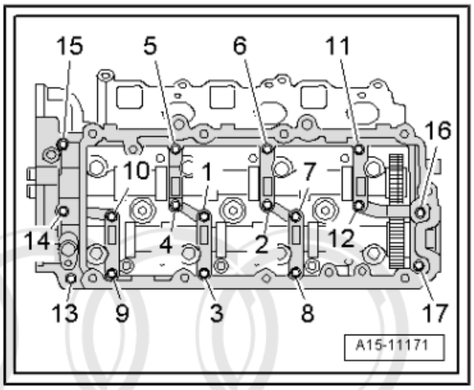


Removing

– Remove timing chain from camshaft ⇒ page 88 on relevant cylinder bank.

– Remove cylinder head cover (right-side) ⇒ page 127 .

- Unscrew retaining frame bolts and nuts in the sequence -17 ... 1-.



Note

Make sure you do not damage roller rocker fingers and compensation elements when removing camshafts.

- Carefully remove retaining frame and camshafts.

Installing

Caution

The camshafts MUST be installed using the camshaft fitting tool -T40094- as described in the following, as the thrust bearings in the retaining frame would otherwise be destroyed. The cylinder head would then have to be renewed.

WARNING

Wear safety goggles.

- Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.

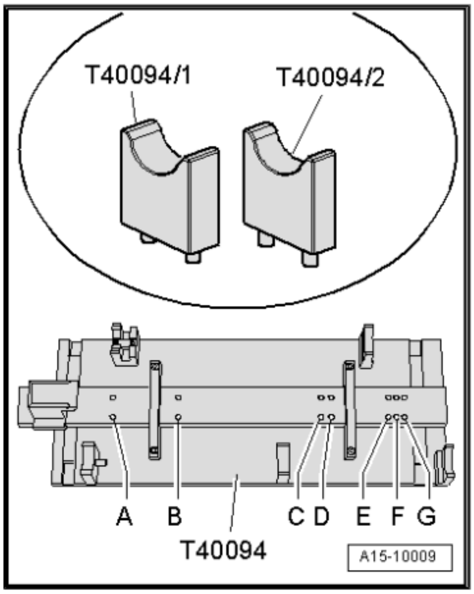
Caution

Make sure that no sealant residue gets into the cylinder head or the bearings.

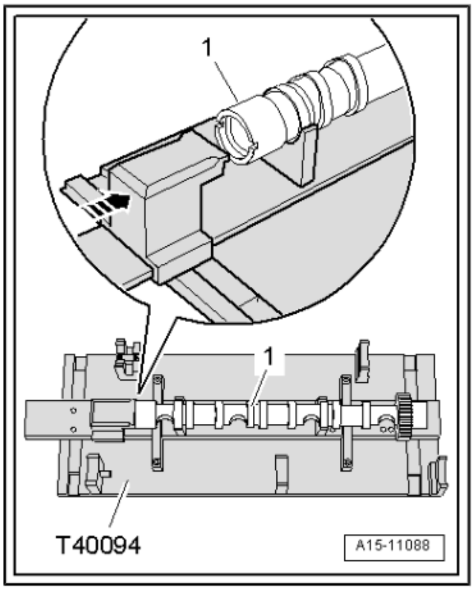
- Clean sealing surfaces; they must be free of oil and grease.
- Lubricate running surfaces of camshafts.

Set up camshaft fitting tool -T40094- as follows:

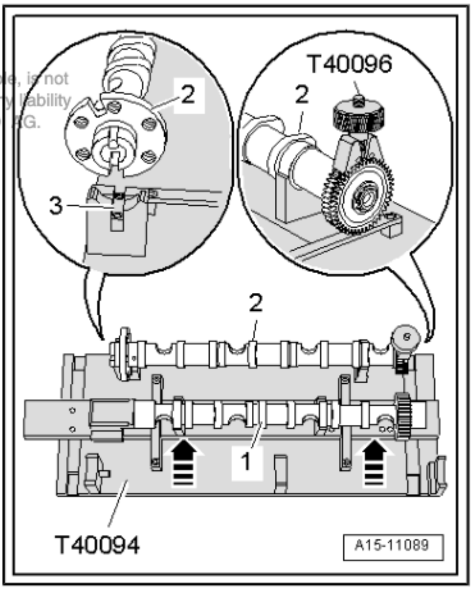
- Insert support -T40094/2- in position -B-.
- Insert support -T40094/1- in position -C-.



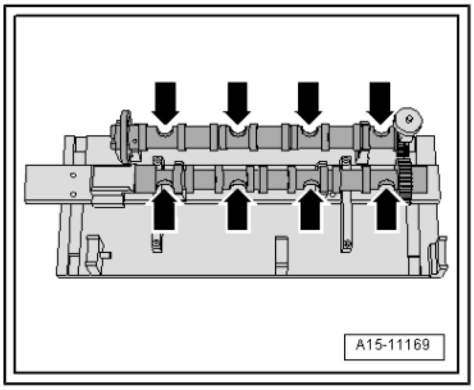
- Place exhaust camshaft -1- in supports -T40094/1- and -T40094/2- .
- Turn exhaust camshaft in such a way that it can be locked in „TDC“ position using locking device -arrow-.



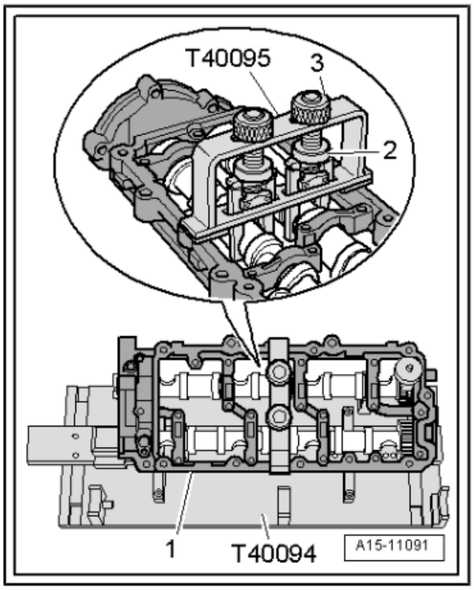
- Place inlet camshaft -2- in camshaft fitting tool -T40094- .
- The locating bar -3- must engage in the groove on the inlet camshaft.
- Place camshaft fitting tool -T40096- on teeth of inlet camshaft in such a way that the two arms of the tool engage on the two halves of the gear (one in each half, as shown in illustration).
- Tighten the clamping tool using the knurled wheel so that the faces of the gear teeth are in alignment.
- Slide exhaust camshaft -1- towards inlet camshaft -arrows- until gear teeth engage.



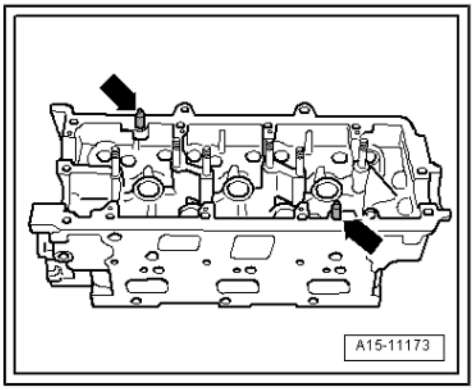
- Check that camshafts are in correct position:
- Recesses -arrows- on both camshafts must point outwards.



- Fit retaining frame -1- on both camshafts.
- All camshaft bearings must be seated on the camshafts.
- Attach camshaft fitting tool -T40095- to camshafts (align arms of bracket as required and tighten knurled nuts -2-).
- Apply tension to camshafts by tightening the knurled nuts -3- upwards.



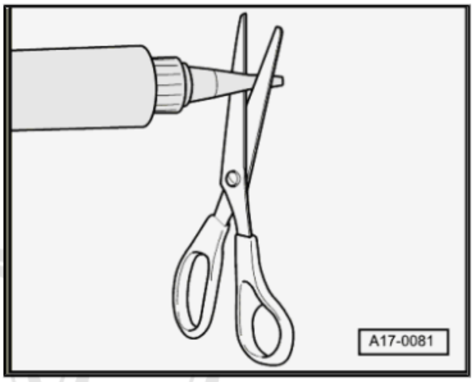
- Check if dowel pins -arrows- are fitted in cylinder head. Install missing dowel pins.



Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle ∅ approx. 1.5 mm).



Note

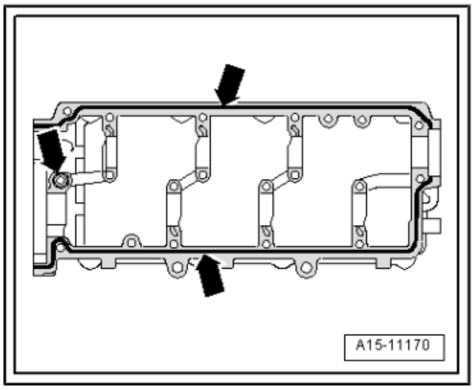
For illustration purposes, the retaining frame is shown without the camshafts.

– Turn retaining frame upside down.

Caution

Make sure lubrication system is not clogged by excess sealant.

- ◆ *The sealant beads must not be thicker than specified.*



– Apply beads of sealant -arrows- onto clean sealing surfaces of retaining frame as shown in illustration.

- The grooves on the sealing surface must be completely filled with sealant.
- The beads of sealant must project 1.5 … 2.0 mm above the sealing surface.

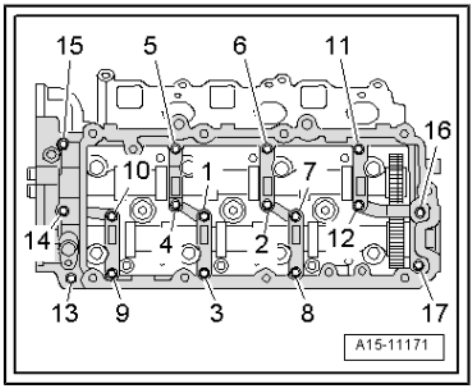
Note

The retaining frame must be installed within 5 minutes after applying the sealant.

Caution

Risk of damage to engine.

- ◆ *Ensure that all roller rocker fingers contact the valve ends and compensation elements correctly.*



- Fit retaining frame together with both camshafts and camshaft fitting tool -T40095- onto cylinder head.
- Tighten bolts for retaining frame ⇒ page 147 .
- Remove camshaft fitting tool -T40095- and -T40096- .

Perform further installation in reverse order, paying attention to the following:

Note

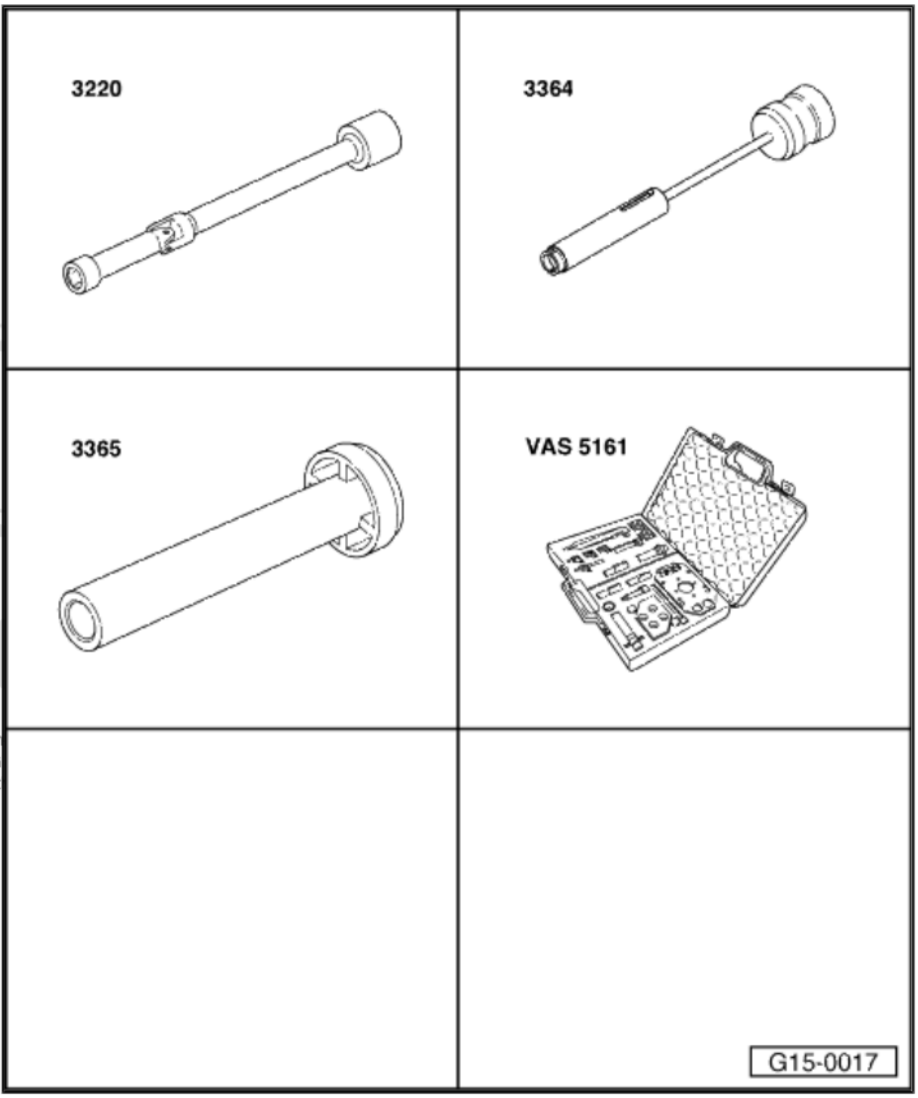
- *After installing camshafts, wait for approx. 30 minutes before starting engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.*

- Install cylinder head cover (right-side) ⇒ page 127 .
- Renew sealing cap (front) on cylinder head.
- Using a suitable drift, knock in new sealing cap (core plug) until flush.
- Install camshaft timing chains ⇒ page 84 .

3.7 Renewing valve stem oil seals with cylinder head installed

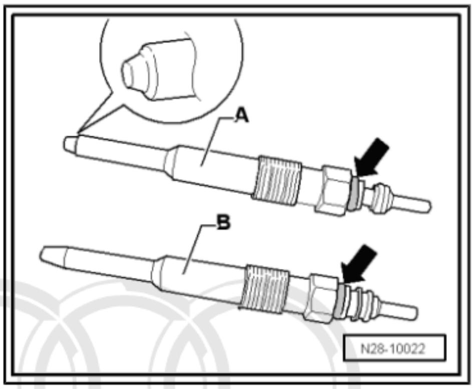
Special tools and workshop equipment required

- U/J extension and socket, 10 mm -3220-
- Valve stem seal puller -3364-
- Valve stem seal fitting tool -3365-
- Removal and installation device for valve cotters -VAS 5161- with knurled spacer ring -VAS 5161/23-1- and guide plate -VAS 5161/23-



Procedure

Up to autumn 2004, two different types of glow plugs are fitted in the Audi A8 with 6-cylinder 3.0 ltr. TDI engine; from autumn 2004 onwards, these engines are fitted exclusively with metal glow plugs. Distinguishing features:



A - Ceramic glow plugs are colour-coded with a „white seal“ -arrow- and have a chamfered shoulder at the tip.

B - Metal glow plugs are colour-coded with a „red seal“ -arrow-.

The metal glow plugs do not require any special handling procedures.

Vehicles with ceramic glow plugs:

Caution

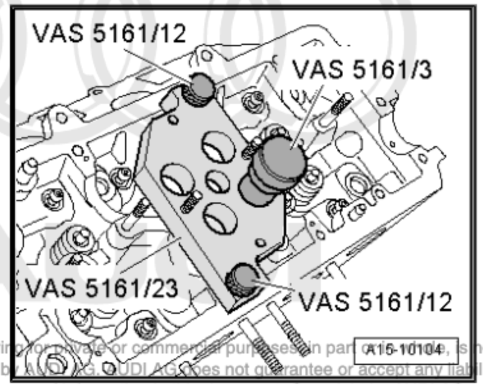
- *Due to the special properties of the material used, ceramic glow plugs are easily damaged and require extra care when handling and removing/installing. Always observe the special instructions when removing and installing ceramic glow plugs ⇒ Rep. gr. 28 .*
- *Transport and store only in original packaging or packed separately in bubble wrap.*
- *Do not remove new ceramic glow plugs from packaging until they are ready to be fitted.*
- *Ceramic glow plugs are sensitive to knocks and bending. For this reason, ceramic glow plugs which have been dropped (even from a height of only about 2 cm) must not be installed, even if no damage is apparent (hair-line cracks may not be visible).*
- *Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.*
- *Damaged glow plugs (e.g. heater pin of the glow plug is damaged) will invariably cause engine damage.*
- *If the heater pin of the glow plug is damaged, the fragments must be removed from the combustion chamber before starting the engine for the first time, otherwise this will invariably cause mechanical damage (piston seizure).*
- *The software of the engine control unit is programmed specifically for either the ceramic or the metal glow plugs, so it is important to install the correct type.*
- *Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.*

Vehicles with metal glow plugs:

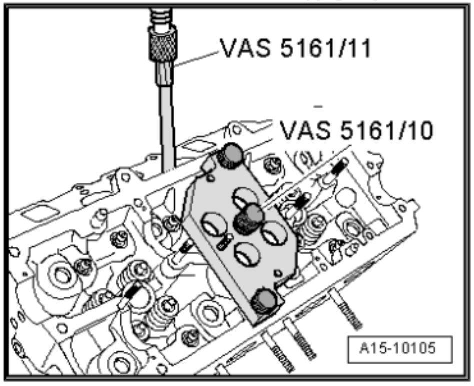
– Remove all glow plugs using U/J extension and socket -3220- .

All vehicles:

- Remove camshafts: cylinder head (left-side) ⇒ page 154 , cylinder head (right-side) ⇒ page 161 .
- Fit guide plate -VAS 5161/23- onto cylinder head.
- Secure guide plate using knurled screws -VAS 5161/12- .
- Insert punch -VAS 5161/3- into guide plate and knock sticking valve cotters loose using a plastic hammer.



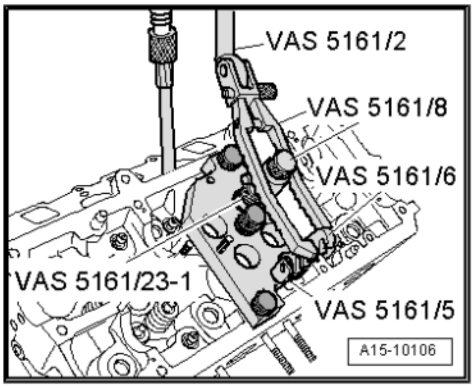
- Screw sealing pin -VAS 5161/10- into guide plate.
- Screw adapter -VAS 5161/11- hand-tight into the glow plug thread of the relevant cylinder.



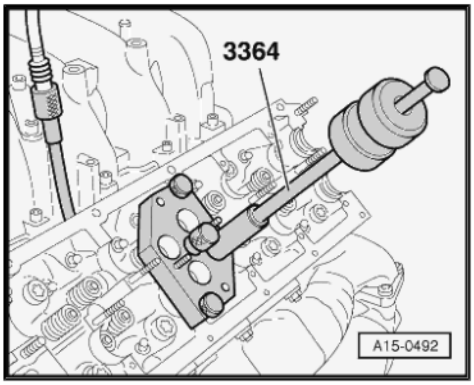
- Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
- Slide knurled spacer ring -VAS 5161/23-1- onto assembly cartridge -VAS 5161/8- .
- Connect adapter to compressed air line using a commercially available connection piece, and apply constant air pressure.

- Minimum pressure: 6 bar

- Hook pressure fork -VAS 5161/2- into snap-in device and press assembly cartridge downwards.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take off assembly cartridge with knurled spacer ring.
- Remove valve spring plate and valve spring.

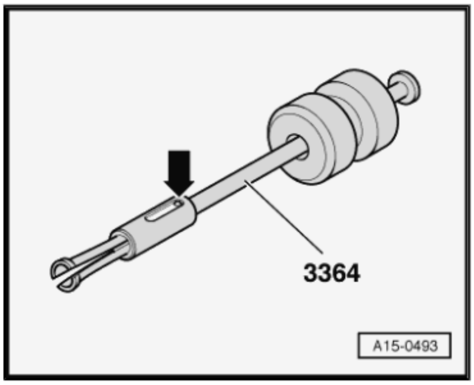


- Remove valve stem oil seals using the valve stem seal puller -3364- .

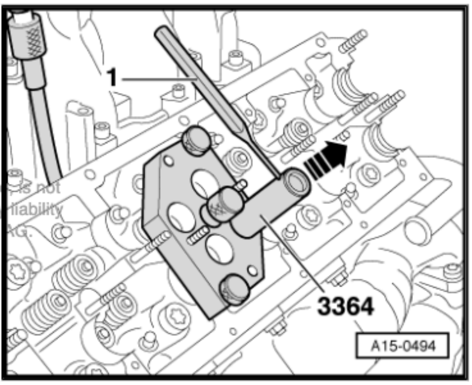


If the puller cannot be used on some of the valve stem oil seals due to the confined space, proceed as follows:

- Knock out pin -arrow- of puller using a punch and remove the extractor attachment.

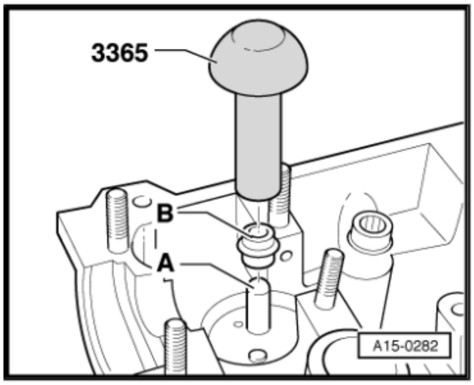


- Apply lower part of puller to valve stem oil seal.
- Secure puller with a punch -1- or other suitable tool as shown in the illustration.
- Apply a suitable tool to puller and pull out valve stem oil seal -arrow-.



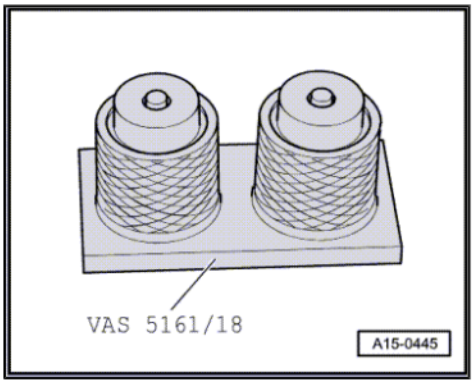
Note

A plastic sleeve -A- is included with the new valve stem oil seals.



- Fit plastic sleeve -A- onto the valve stem to prevent damage to the new valve stem oil seal -B-.
- Lightly lubricate sealing lip of valve stem oil seal.
- Slip valve stem oil seal over plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .
- Remove plastic sleeve.

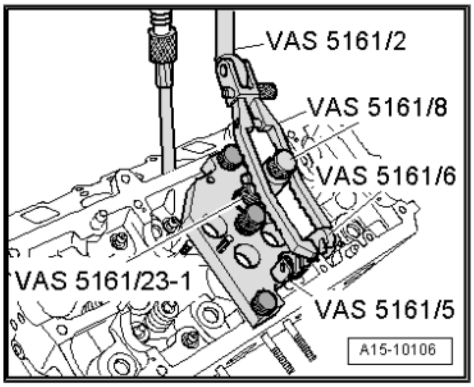
- If valve cotters have been removed from assembly cartridge -VAS 5161/8- , they need to be put into insertion device for valve cotters -VAS 5161/18- first.



Note

Larger diameter of valve cotters faces upwards.

- Insert valve spring and valve spring plate.
- Press assembly cartridge onto insertion device from above and take up valve cotters.



- Re-insert assembly cartridge into guide plate -VAS 5161/23- .
- Push pressure fork down and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.

Installation is carried out in the reverse order; note the following:

- Install glow plugs ⇒ Rep. gr. 28 .
- Install camshafts: cylinder head (left-side) ⇒ page 154 , cylinder head (right-side) ⇒ page 161 .

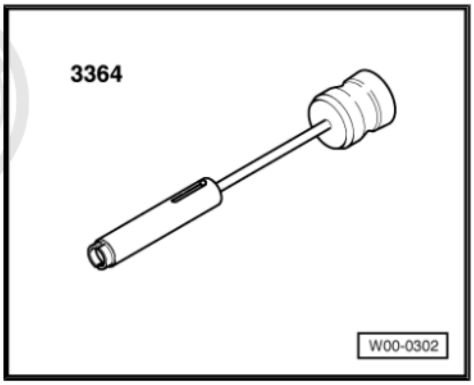
Note

- *Engine is not to be rotated for approx. 30 minutes after installing camshafts. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

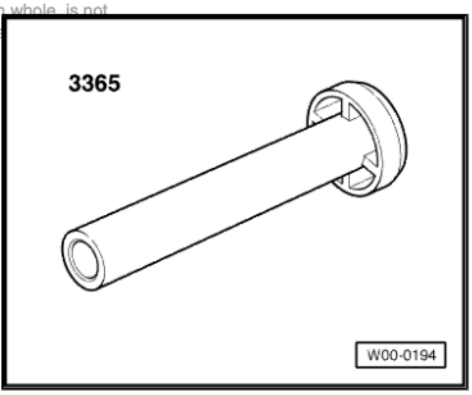
3.8 Renewing valve stem oil seals with cylinder head removed

Special tools and workshop equipment required

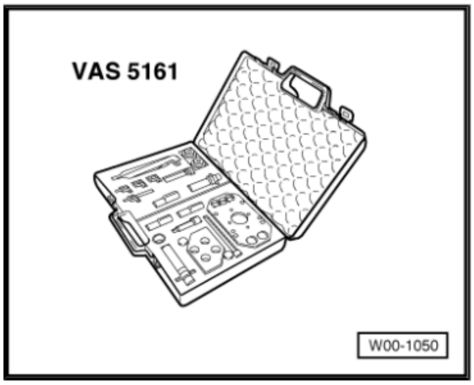
- Valve stem seal puller -3364-



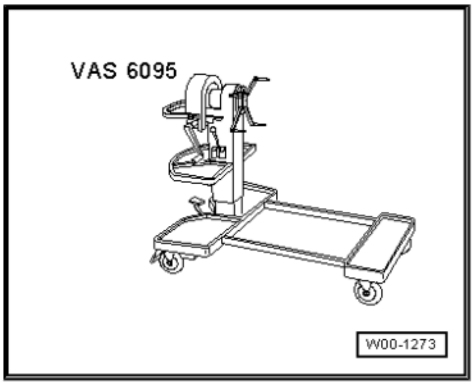
- Valve stem seal fitting tool -3365-



- Removal and installation device for valve cotters -VAS 5161- with knurled spacer ring -VAS 5161/23-1- and guide plate -VAS 5161/23-



- Engine and gearbox support -VAS 6095-



- Cylinder head tensioning device -VAS 6419-

Procedure

– Remove camshafts: cylinder head (left-side) ⇒ page 154 , cylinder head (right-side) ⇒ page 161 .

– Mark original positions of roller rocker fingers and hydraulic compensation elements for reinstallation.

– Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.

– Insert cylinder head tensioning device -VAS 6419- into engine and gearbox support -VAS 6095- .

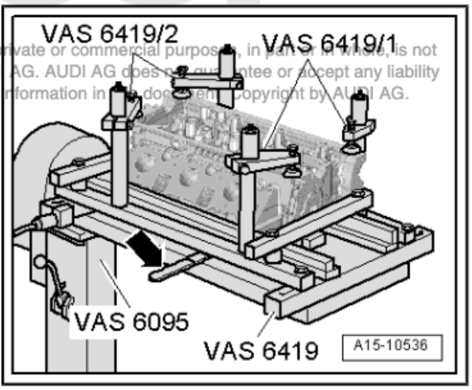
– Secure cylinder head in cylinder head tensioning device -VAS 6419- , as illustrated.

– Connect cylinder head tensioning device to compressed air.

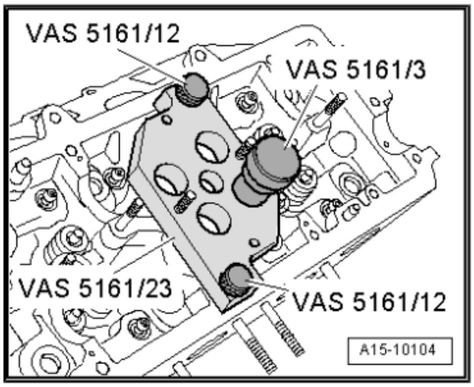
– Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seals are to be removed.

– Apply just enough compressed air to bring air pad into contact with valve heads.

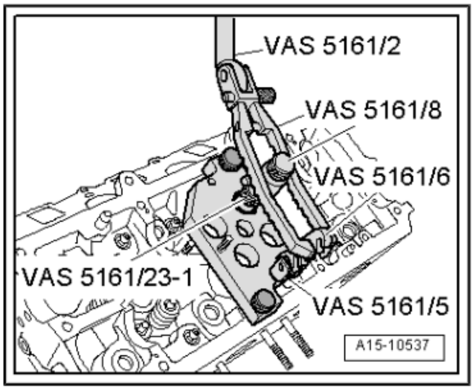
– Mark fitting location of roller rocker fingers for re-installation and remove.



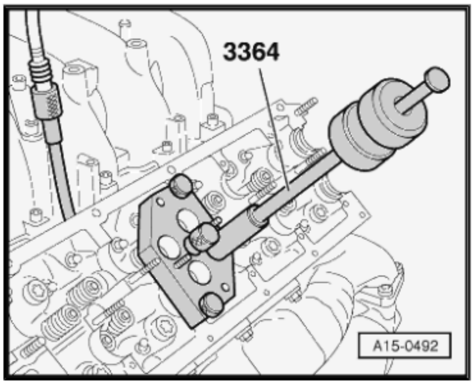
- Fit guide plate -VAS 5161/23- onto cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- .
- Insert drift -VAS 5161/3- into guide plate and use plastic-headed hammer to release sticking valve cotters.



- Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
- Slide knurled spacer ring -VAS 5161/23-1- onto assembly cartridge -VAS 5161/8- .
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take off assembly cartridge with knurled spacer ring.
- Detach valve spring with valve spring plate.



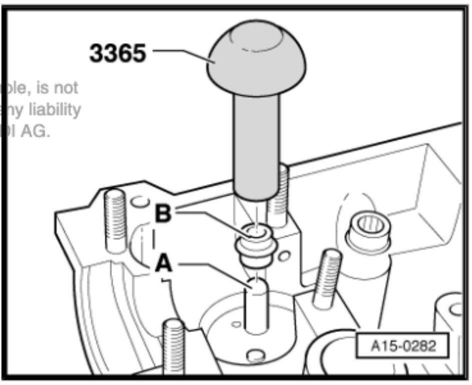
- Pull off valve stem oil seal with valve stem seal puller -3364- .



Caution

Make sure valve stem oil seals are not damaged when installing.

- ◆ *New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.*



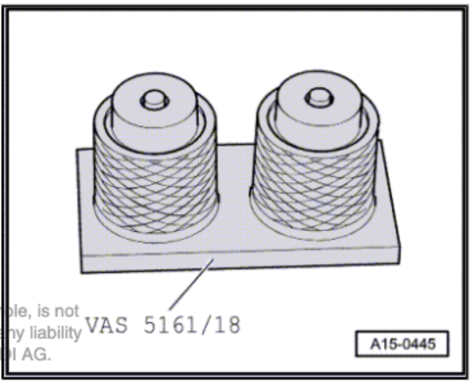
- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool -3365- .
- Take off plastic sleeve.

If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

- Larger diameter of valve cotters faces upwards.

– Insert valve spring and valve spring plate.

– Press assembly cartridge onto insertion device from above and take up valve cotters.

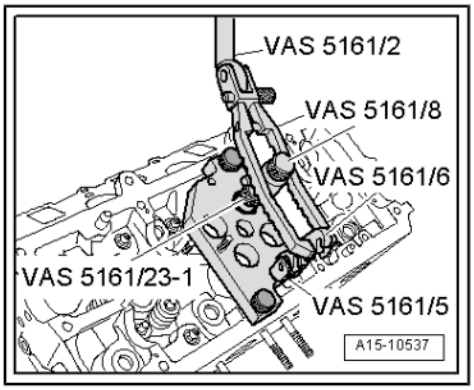


– Insert assembly cartridge in guide plate -VAS 5161/23- again.

– Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.

– Release the pressure fork with knurled screw still in pulled position.

– Repeat procedure for each valve.



Assembling

Installation is carried out in the reverse order; note the following:

– Install camshafts: cylinder head (left-side) ⇒ page 154 , cylinder head (right-side) ⇒ page 161 .

3.9 Checking hydraulic valve compensation elements

Special tools and workshop equipment required

◆ Feeler gauge

Note

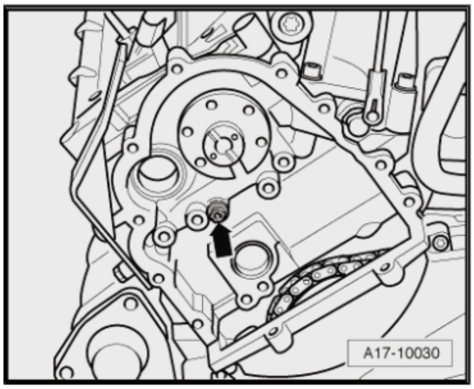
◆ *Hydraulic valve compensation elements cannot be serviced.*

◆ *Irregular valve noises when starting engine are normal.*

Procedure

– Start engine and run until coolant temperature reaches approx. 80 °C.

– Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).

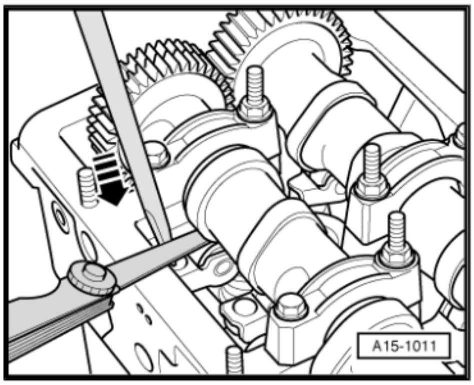


Note

If the irregular valve noise stops but repeatedly re-occurs when driving short distances, the oil retention valve -arrow- at the rear end of the respective cylinder head must be renewed.

If the hydraulic tappets are still noisy, locate defective tappet as follows:

- Remove cylinder head cover (left or right) ⇒ page 127 .
- Rotate crankshaft until cam of hydraulic compensation element to be checked faces upwards (remove noise insulation panel and rotate crankshaft clockwise via central bolt for vibration damper).



- Determine clearance between cam and roller rocker finger.
- Press roller rocker finger down -arrow- using a screwdriver.

If it is possible to insert a feeler gauge of 0.20 mm between camshaft and roller rocker finger:

- Renew hydraulic compensation element ⇒ „3.5 Removing and installing camshafts - cylinder head (left-side)“, page 154 .

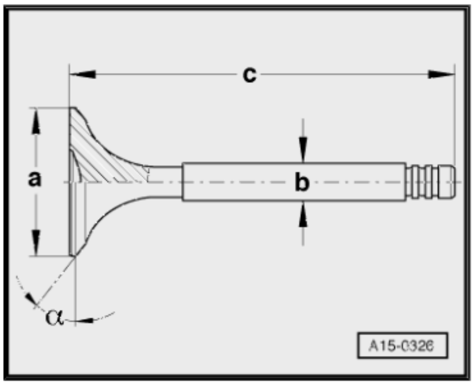
3.10 Checking valves

- Visually inspect for scoring on valve stem and on seating surface.

If scoring is clearly visible:

- Renew the relevant valve.

3.11 Valve dimensions



Note

Inlet and exhaust valves must not be machined. Only grinding-in is permitted.

Dimension		Inlet valve	Exhaust valve
∅ a	mm	28.60 … 28.80	26.70 … 26.90
∅ b	mm	5.968 … 5.982	5.958 … 5.972
c	mm	97.25 … 97.45	97.35 … 97.55
α	∠°	45	45

WARNING

- *Care must be taken when disposing of old sodium-cooled exhaust valves.*
- *The valves must be sawn in two with a metal saw between the centre of the stem and valve head. When doing so, the valves must not come into contact with water. After preparing the valves, throw a maximum of ten into a bucket of water. Then step away immediately, since a chemical reaction will occur in which the sodium filling burns.*
- *After performing these steps the valves can be disposed of in the normal way.*

3.12 Machining valve seats

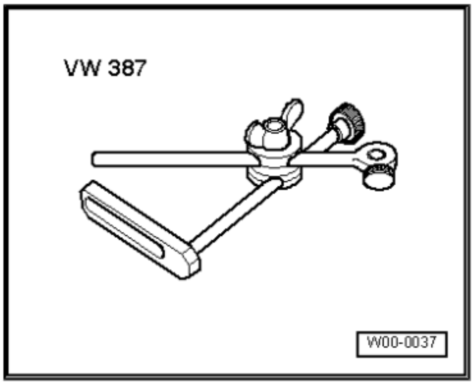
Note

Valve seats may not be machined due to the very small tolerances.

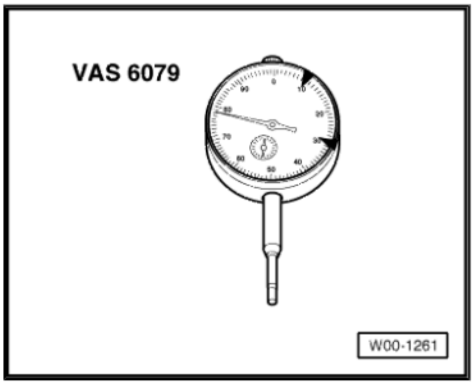
3.13 Checking valve guides

Special tools and workshop equipment required

- Universal dial gauge bracket -VW 387-



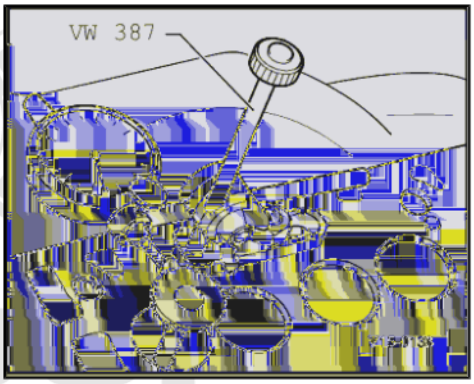
- Dial gauge -VAS 6079-



Procedure

– Insert valve into valve guide.

- End of valve stem must be flush with valve guide.



Note

Only insert inlet valve into inlet guide and exhaust valve into exhaust guide, as the stem diameters are different.

– Determine amount of sideways play.

- Wear limit for inlet and exhaust valve guide: max. 1.0 mm.

Note

- *If the wear limit is exceeded, repeat the measurement with new valves. Renew cylinder head if wear limit is still exceeded. Valve guides cannot be renewed.*
- *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*

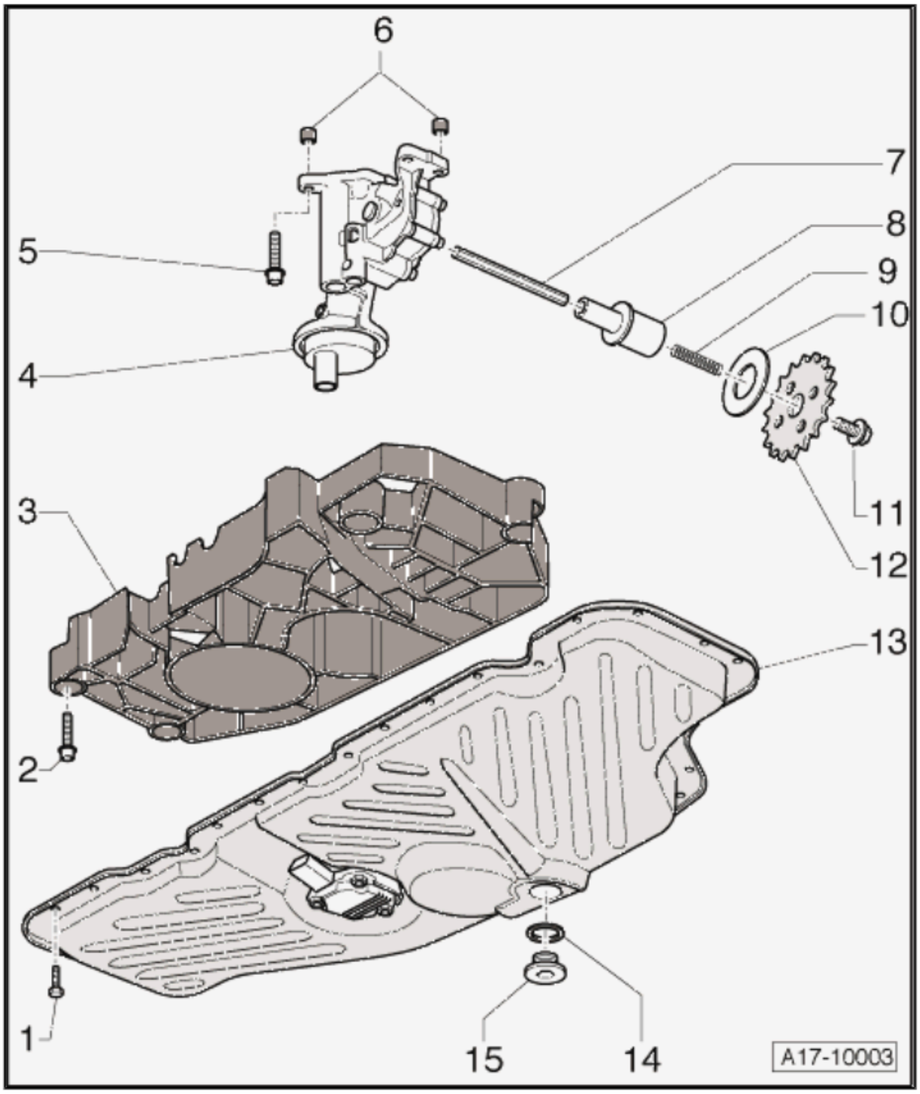
17 – Lubrication

1 Removing and installing parts of lubrication system

Note

- *If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler must be renewed in order to prevent further damage occurring later.*
- *The oil level must not be above max. mark on dipstick – danger of damage to catalytic converter.*
- *Refer to ⇒ Maintenance tables for engine oil capacity, oil specifications and viscosity grades.*
- *Oil spray jet for piston cooling ⇒ page 179 .*
- *Oil retention valves ⇒ page 179*

1.1 Oil pump, sump (bottom section) - exploded view



1 - 8 Nm + 90° ($^{1}/_{4}$ turn) further
  - ☐ Renew
  - ☐ Tighten in stages and in diagonal sequence

2 - 8 Nm + 90° ($^{1}/_{4}$ turn) further
  - ☐ Self-locking
  - ☐ Renew

3 - Baffle plate

4 - Oil pump
  - ☐ Do not dismantle
  - ☐ With pressure relief valve for cold condition (11 bar) and pressure control valve (3.5 bar)
  - ☐ Removing and installing ⇒ page 182

5 - 23 Nm

6 - Dowel sleeves

7 - Oil pump drive shaft

8 - Coupling

9 - Compression spring

10 - Thrust washer

11 - 64 Nm
  - ☐ Property class 10.9
  - ☐ To loosen, use pin wrench -3212- to counterhold chain sprocket
  - ☐ If bolt cannot be tightened to torque, remove

sump (bottom section) with baffle plate and counterhold oil pump drive shaft using an open-end spanner.

12 - Chain sprocket for oil pump

- ☐ Installation position: Side with lettering faces engine

13 - Sump (bottom section)

- ☐ Removing and installing ⇒ page 180
- ☐ With oil level and oil temperature sender -G266-
- ☐ Removing and installing oil level and oil temperature sender -G266- ⇒ page 180

14 - Seal

- ☐ Renew

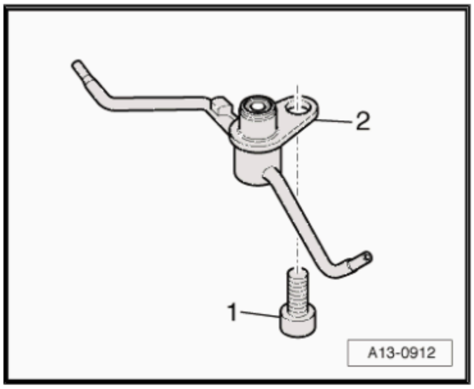
15 - Oil drain plug

- ☐ M14 - 30 Nm
- ☐ M24 - 50 Nm

Oil spray jet for piston cooling

1 - Bolt, 9 Nm

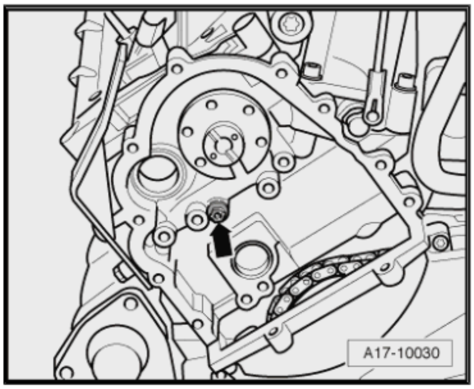
2 - Oil spray jet with spray nozzle valve for piston cooling



Oil retention valves

The oil retention valves are located at the rear end of the cylinder heads (left and right) -arrow-. They are accessible after removing the timing chains from the camshafts (left and right) ⇒ page 88 .

- Tightening torque: 25 Nm.



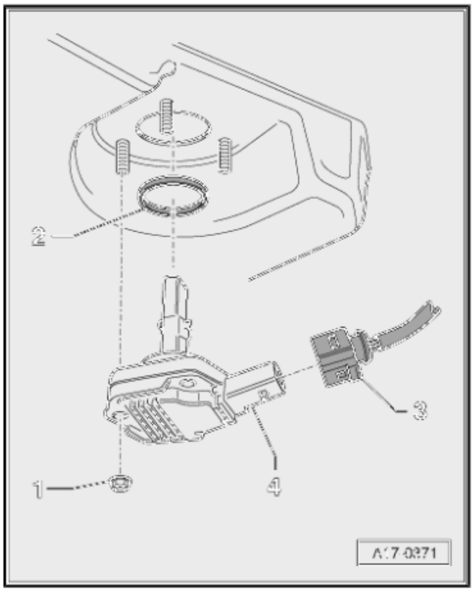
Removing and installing oil level and oil temperature sender -G266-

1 - Nut, 9 Nm

2 - Seal; renew

3 - Electrical connector

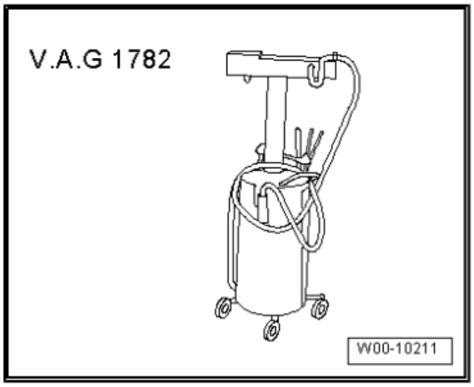
4 - Oil level and oil temperature sender -G266-



1.2 Removing and installing sump (bottom section)

Special tools and workshop equipment required

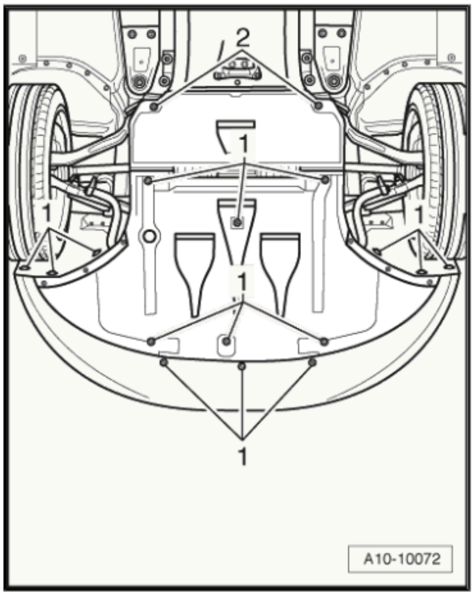
- ♦ Used oil collection and extraction unit -V.A.G 1782-



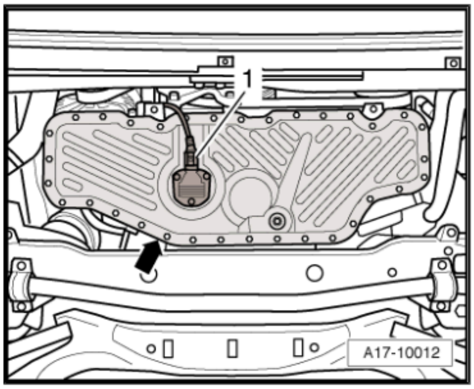
- ♦ Electric drill with plastic brush attachment
- ♦ Safety goggles
- ♦ Sealant ⇒ Parts catalogue

Removing

- Open quick-release fasteners -1- and remove noise insulation (front).
- Place used oil collection and extraction unit -V.A.G 1782- under engine.
- Drain off engine oil.



- Unplug electrical connector at oil level and oil temperature sender -G266- -item 1-.
- Unbolt sump (bottom section) -arrow-.



Installing

Installation is carried out in the reverse order; note the following:

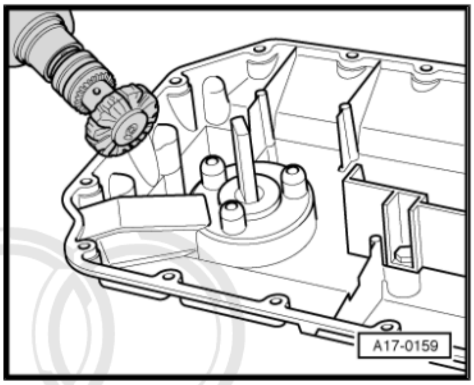
Note

Renew seals.

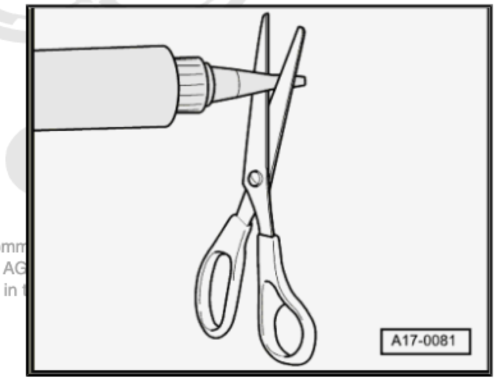
WARNING

Wear safety goggles.

- Remove sealant residue from bottom and top sections of sump with rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.

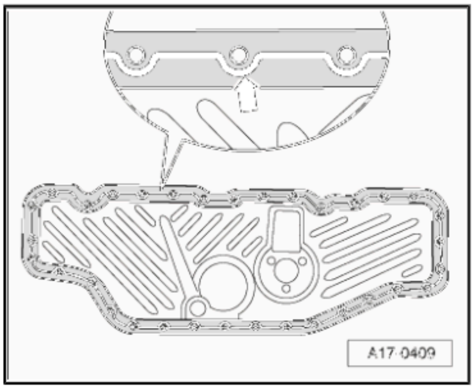


- Cut off tube nozzle at front marking (diameter of nozzle approx. 1.5 mm).



– Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as illustrated.

- Width of sealant bead: 2 mm.



Note

- *The bead of sealant must not be thicker than specified, otherwise excess sealant can enter the sump and obstruct the strainer in the oil intake pipe.*
- *The sump (bottom section) must be installed within 5 minutes after applying sealant.*

– Fit sump (bottom section) and tighten all bolts initially to 5 Nm in diagonal sequence.

– Tighten bolts on sump (bottom section) in diagonal sequence.

– Fill up with engine oil and check oil level ⇒ page 200 .

Tightening torques

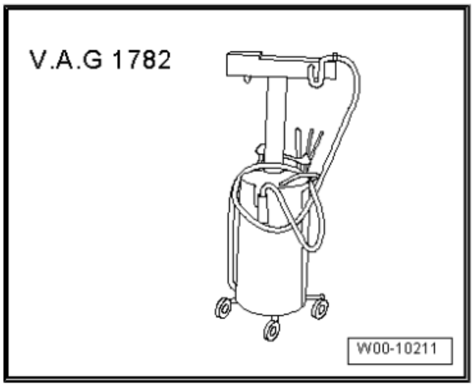
Component		Nm
Sump (bottom section) to sump (top section)		8 + 90° 1)2)
Oil drain plug	M14	30
	M24	50

- 1) Renew bolts.
- 2) 90° = one quarter turn.

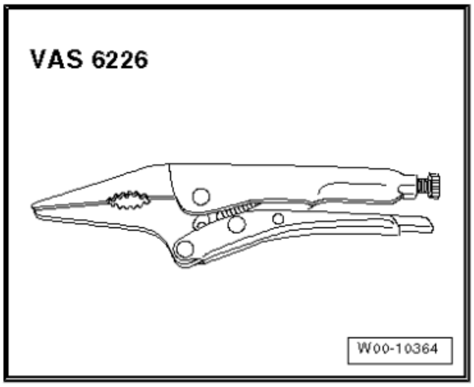
1.3 Removing and installing oil pump

Special tools and workshop equipment required

- Used oil collection and extraction unit -V.A.G 1782-



- Long-nose grip pliers -VAS 6226-

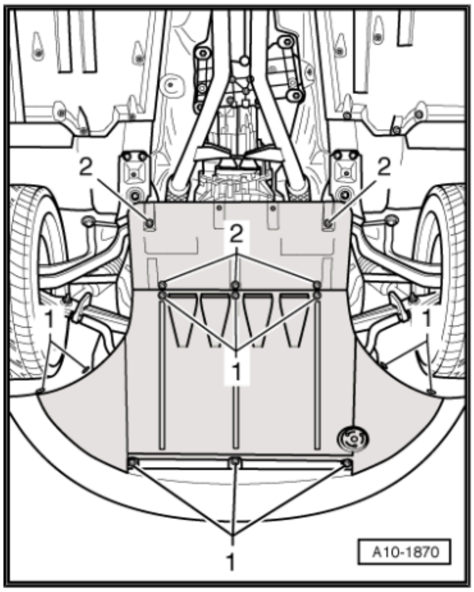


Removing

– Open quick-release fasteners -1- and remove noise insulation (front).

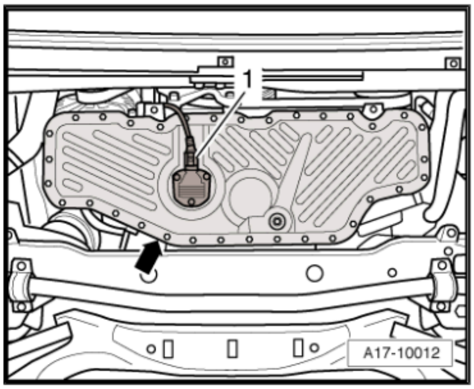
– Place used oil collection and extraction unit -V.A.G 1782- under engine.

– Drain off engine oil.

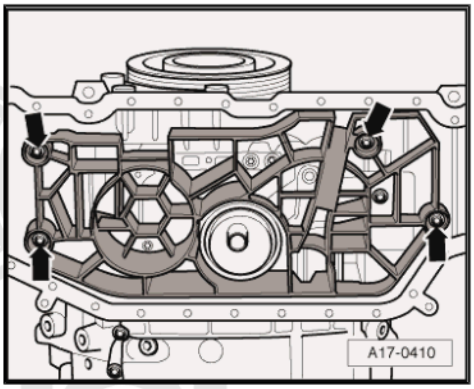


– Unplug electrical connector at oil level and oil temperature sender -G266- -item 1-.

– Unbolt sump (bottom section) -arrow-.



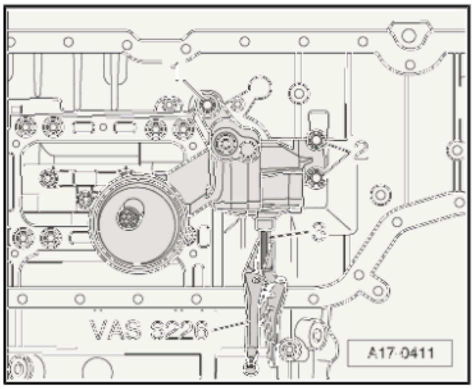
– Detach baffle plate -arrows-.



– Unscrew bolts -1- and -2-.

– Hold oil pump drive shaft -3- firmly with long-nose grip pliers - VAS 6226- and push shaft back against spring pressure.

– Take out oil pump.



Note

Oil pump drive shaft remains in position.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seals and O-rings.

– Check that the two dowel sleeves are fitted in the oil pump; install if necessary.

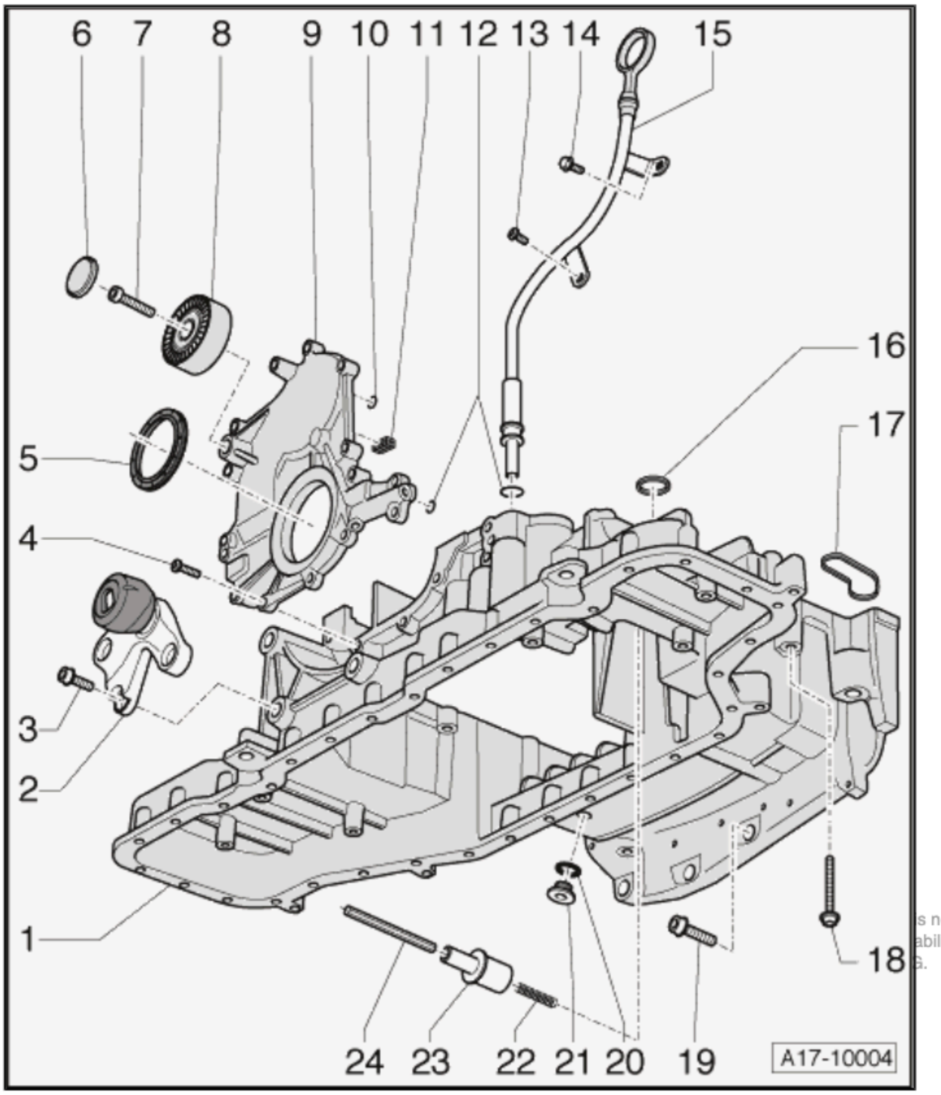
– Install sump (bottom section) ⇒ page 181 .

– Fill up with engine oil and check oil level ⇒ page 200 .

Tightening torques

Component	Nm
Oil pump to sump (top section)	23
Baffle plate to sump (top section)	8 + 90° 1)2)
• 1) Renew bolts. • 2) 90° = one quarter turn.	

1.4 Sump (top section) - exploded view



1 - Sump (top section)
- ☐ Removing and installing ⇒ page 186

2 - Torque reaction support

3 - 40 Nm

4 - 9 Nm
- ☐ Tighten in stages and in diagonal sequence

5 - Crankshaft oil seal (pulley end)
- ☐ Renewing ⇒ page 58

6 - Cover

7 - 23 Nm

8 - Idler roller for poly V-belt
- ☐ Note installation position

9 - Sealing flange (front)
- ☐ Removing and installing ⇒ page 61

10 - O-ring
- ☐ Renew

11 - Sealing element
- ☐ 2x

12 - O-rings
- ☐ Renew

13 - 9 Nm

14 - 9 Nm

15 - Guide tube for oil dipstick

16 - Seal
- ☐ Renew

17 - Seal
- ☐ Renew

18 - 15 Nm
- ☐ Tighten in stages and in diagonal sequence

19 - 45 Nm

20 - Seal
- ☐ Renew

21 - Plug for TDC drilling, 35 Nm

22 - Compression spring

23 - Coupling

24 - Oil pump drive shaft

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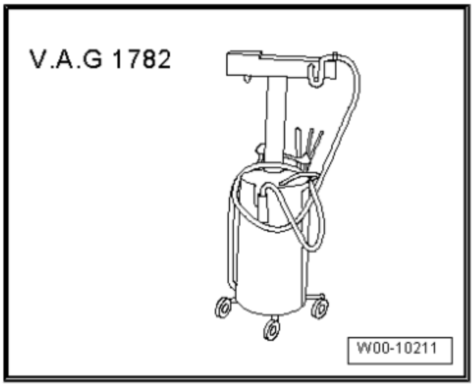
1.5 Removing and installing sump (top section)

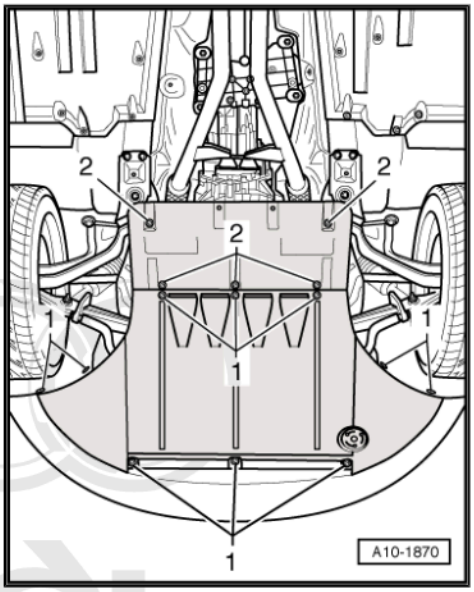
Special tools and workshop equipment required

- Used oil collection and extraction unit -V.A.G 1782-



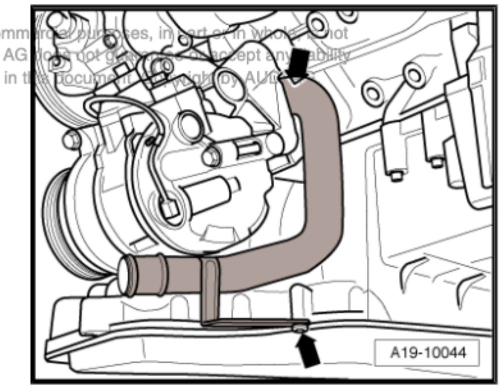
- Safety goggles
- Electric drill with plastic brush attachment
- Sealant ⇒ Parts catalogue

Removing

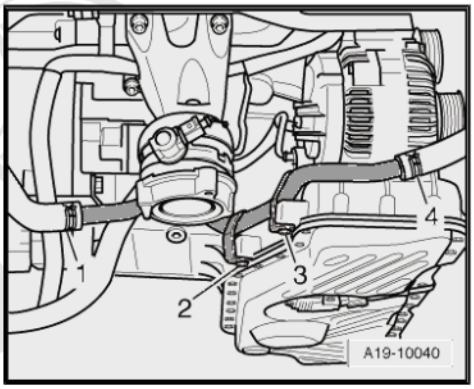


- – Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.
- – Place used oil collection and extraction unit -V.A.G 1782- under engine.
- – Drain off engine oil.
- – Remove engine ⇒ page 8 .
- – Separate engine from gearbox ⇒ page 27 .
- – Secure engine to engine and gearbox support ⇒ page 34 .
- – Remove drive plate ⇒ page 66 .
- – Remove timing chain covers ⇒ page 71 .
- – Remove chain for oil pump and balance shaft ⇒ page 102 .
- – Remove sealing flange (front) ⇒ page 61 .
- – Remove sump (bottom section) ⇒ page 180 .
- – Remove oil pump ⇒ page 182 .

- – Remove bolts -arrows- and take off coolant pipe (left-side).



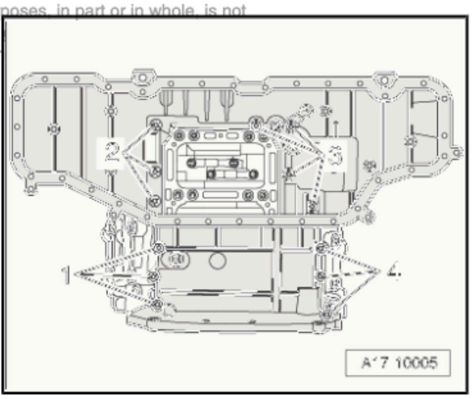
- Remove bolts -2- and -3- and take off coolant pipe (bottom right).



Note

Disregard items -1- and -4-.

- Remove bolts -1 … 4- for sump (top section).
- Press sump (top section) off spring pins on cylinder block.



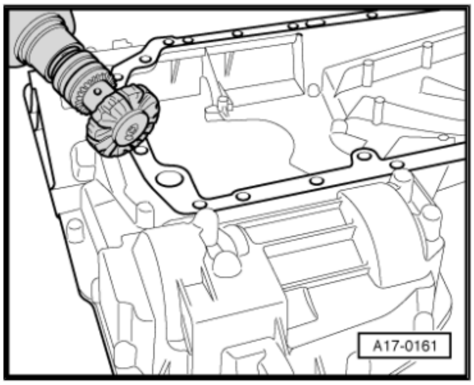
Installing

Note

Renew gaskets, seals and O-rings.

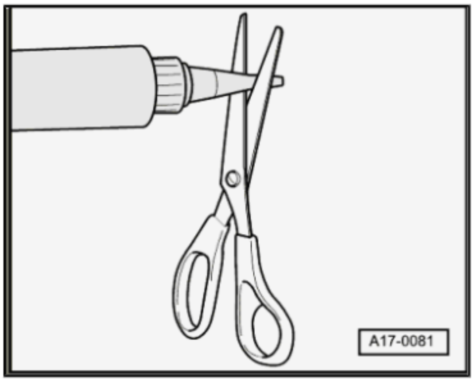
- Remove old sealant from grooves in sump (top section) and from sealing surfaces.

> **WARNING**
>
> *Wear safety goggles.*

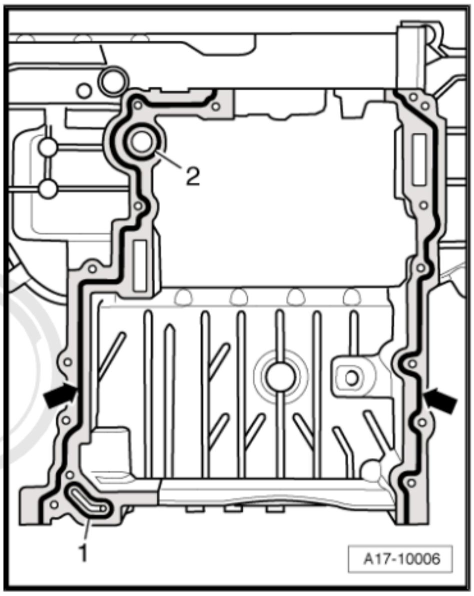


- Remove sealant residue from sump (top section) and cylinder block with rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.

- Cut off nozzle of tube at front marking (∅ of nozzle approx. 1.5 mm).



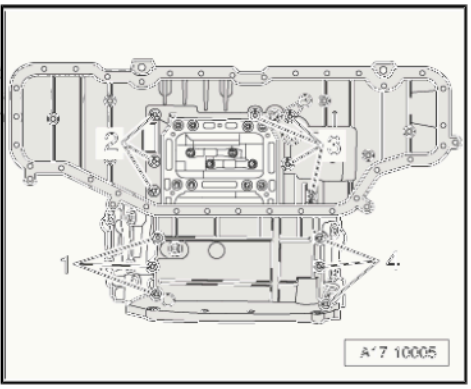
- Install seals -1- and -2- in top section of sump.



- Apply beads of sealant -arrows- onto clean sealing surface of sump (top section) as illustrated.
- The grooves -arrows- on the sealing surfaces must be completely filled with sealant.
- The beads of sealant must project 1.5 … 2.0 mm above the sealing surface.

Note

- ◆ *The sealant beads must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- ◆ *The sump (top section) must be installed within 5 minutes after applying sealant.*



- Fit sump (top section) and tighten bolts -1 … 4- in diagonal sequence to 5 Nm.
- Tighten bolts -1 … 4- in diagonal sequence.

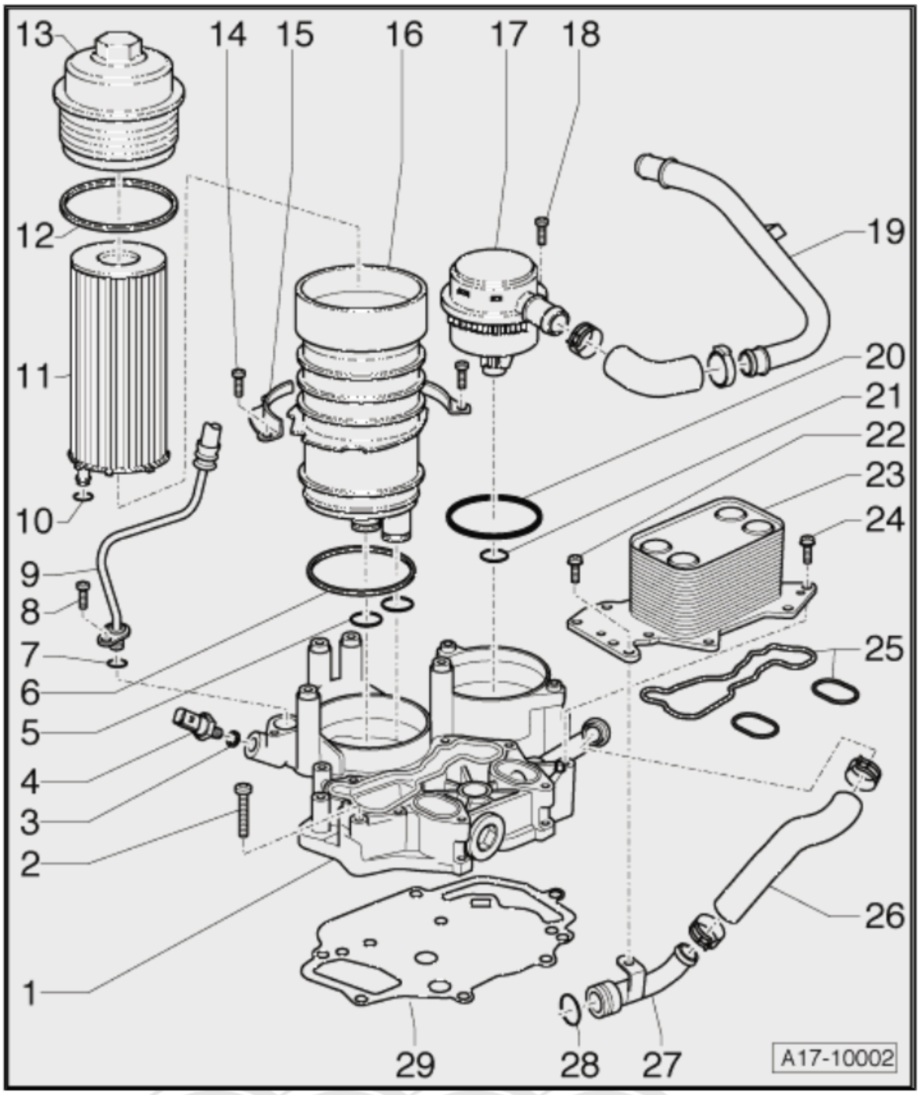
Remaining installation steps are carried out in reverse sequence; note the following:

- Install oil pump ⇒ page 182 .
- Install sump (bottom section) ⇒ page 181 .
- Install sealing flange (front) ⇒ page 61 .
- Install chain for oil pump and balance shaft ⇒ page 102
- Install timing chain covers ⇒ page 74 .
- Install drive plate ⇒ page 66 .
- Bolt gearbox to engine and install engine/gearbox assembly ⇒ page 36 .
- Fill up with engine oil and check oil level ⇒ page 200 .

Tightening torques

Component		Nm
Sump (top section) to cylinder block		15
Coolant pipe to:	Sump (top section)	9
	Bracket for air conditioner compressor	9

1.6 Oil cooler, pressure control valve, and oil filter housing - exploded view



1 - Mounting plate
  - ☐ For oil cooler, pressure control valve of crankcase breather system, oil filter housing
  - ☐ Removing and installing ⇒ page 196

2 - 9 Nm

3 - Seal
  - ☐ Renew

4 - Oil pressure switch - F1- , 0.9 bar
  - ☐ Grey insulation
  - ☐ Checking ⇒ page 199
  - ☐ Removing and installing ⇒ page 198

5 - O-rings
  - ☐ Renew

6 - Seal
  - ☐ Renew

7 - O-ring
  - ☐ Renew

8 - 9 Nm

9 - Oil supply line
  - ☐ To turbocharger

10 - O-ring
  - ☐ Renew

11 - Oil filter element
  - ☐ Removing and installing ⇒ Maintenance ; Booklet 404

12 - Seal
  - ☐ Renew

13 - Sealing cap, 35 Nm

14 - 9 Nm

15 - Retaining clip

16 - Oil filter housing
  - ☐ Removing and installing ⇒ page 192
  - ☐ With oil filter bypass valve, 2.0 … 3.0 bar (pressure differential upstream/downstream of filter)

17 - Pressure control valve for crankcase breather system
  - ☐ Removing and installing ⇒ page 195

18 - 9 Nm

19 - Crankcase breather pipe

20 - O-ring
  - ☐ Renew

21 - O-ring
- ☐ Renew

22 - 9 Nm

23 - Oil cooler
- ☐ See note ⇒ page 178
- ☐ Removing and installing ⇒ page 190
- ☐ With oil cooler bypass valve, 2.0 … 3.0 bar (pressure differential upstream/downstream of oil cooler)

24 - 9 Nm

25 - Gaskets
- ☐ Renew

26 - Coolant hose

27 - Coolant pipe

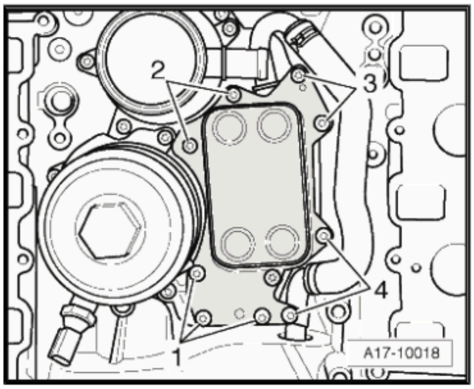
28 - O-ring
- ☐ Renew

29 - Gasket
- ☐ Renew

1.7 Removing and installing oil cooler

Removing

- Drain off coolant ⇒ page 202 .
- Move lock carrier to service position ⇒ page 43 .
- Remove intake manifold (top section) ⇒ Rep. gr. 23 .
- Remove bottom section of intake manifold (left or right) ⇒ Rep. gr. 23 .
- Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Remove high-pressure pump ⇒ Rep. gr. 23 .
- Remove exhaust gas recirculation cooler ⇒ page 301 .
- Spread out rags round oil cooler to catch escaping oil.



– Remove bolts -1 … 5- and take out oil cooler.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seals and O-ring for top coolant pipe.

– Install exhaust gas recirculation cooler ⇒ page 301 .

– Install high-pressure pump ⇒ Rep. gr. 23 .

– Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

– Install bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .

– Install intake manifold (top section) ⇒ Rep. gr. 23 .

– Install lock carrier with attachments ⇒ Rep. gr. 50 .

– Install bumper cover (front) ⇒ Rep. gr. 63 .

– Fill up with engine oil and check oil level ⇒ page 200 .

– Fill cooling system ⇒ page 204 .

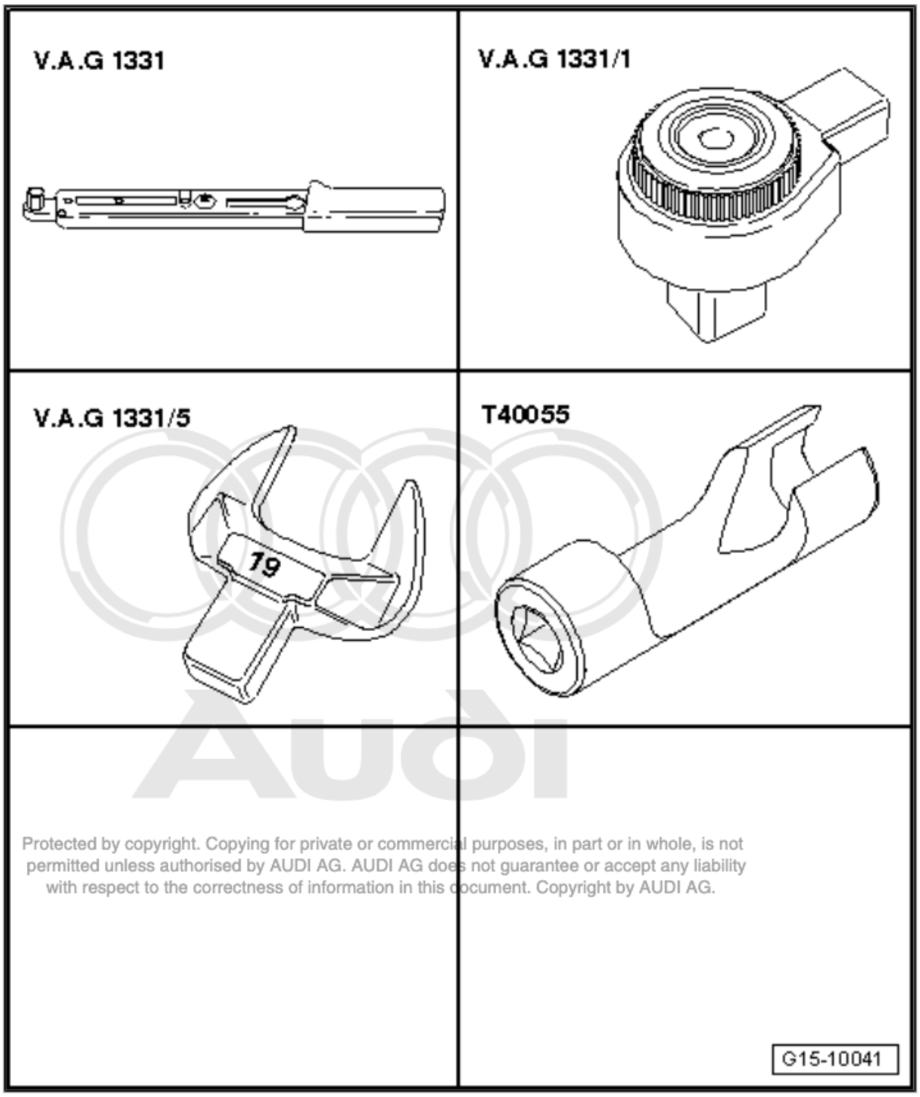
Tightening torques

Component	Nm
Oil cooler to mounting plate	9
Top coolant pipe to oil cooler	9

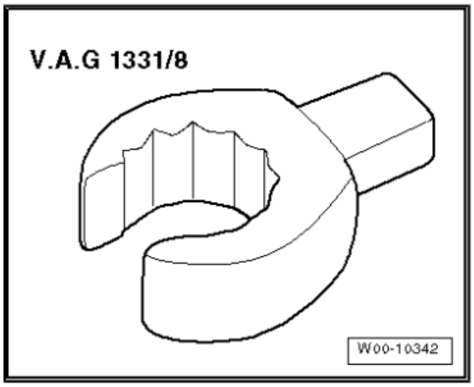
1.8 Removing and installing oil filter housing

Special tools and workshop equipment required

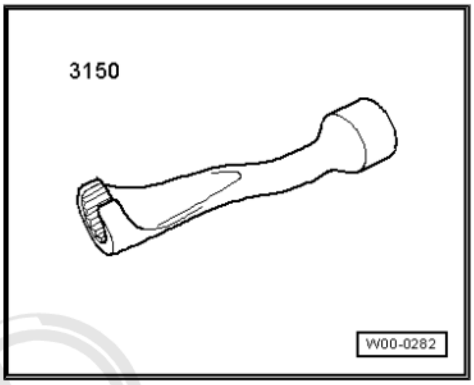
- Torque wrench -V.A.G 1331-
- Tool insert, AF 19 -V.A.G 1331/5- for vehicles from 08.2005 onwards
- Ratchet -V.A.G 1331/1-
- Socket -T40055- for vehicles from 08.2005 onwards



- Socket insert AF 14, flared ring spanner -V.A.G 1331/8- for vehicles up to 08.2005

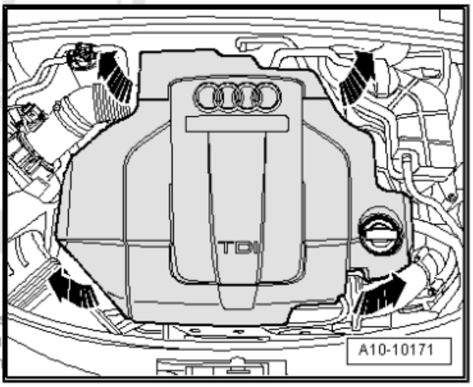


- Socket, 14 mm -3150- for vehicles up to 08.2005



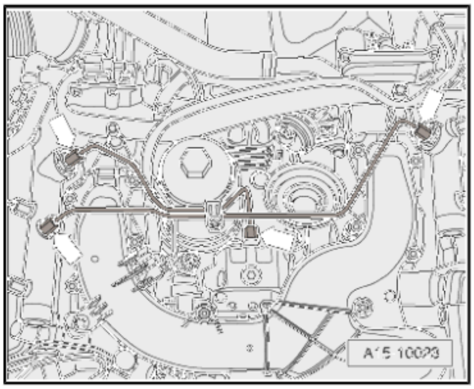
Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



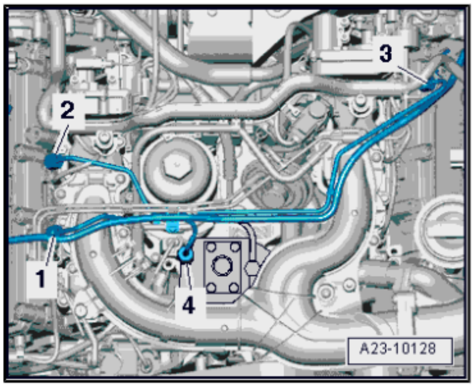
Vehicles up to 08.2005:

– Unscrew union nuts -arrows- and detach high-pressure pipes.



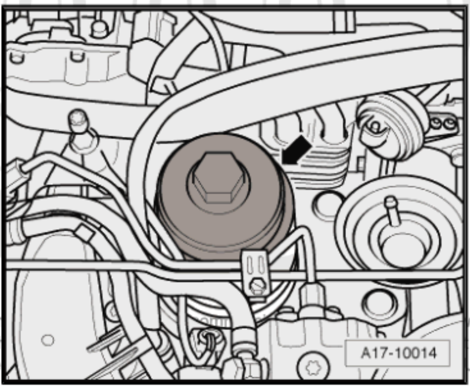
Vehicles from 08.2005 onwards:

– Unscrew union nuts -1 ... 4- and detach high-pressure pipes.



All vehicles:

- Remove intake manifold (top section) ⇒ Rep. gr. 23 .
- Loosen sealing cap -arrow- using 32 mm socket. Take off sealing cap together with oil filter element.
- Pull oil filter element off sealing cap.



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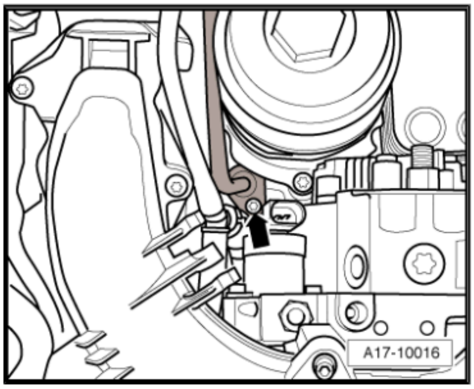
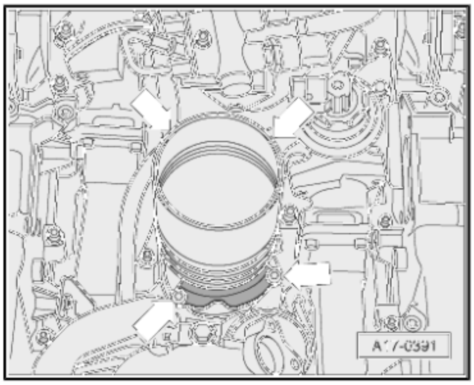
- Disconnect oil supply line -arrow- from mounting plate.



- Unbolt retaining clip -arrows-.
- Spread out rags round oil filter housing to catch escaping oil.
- Pull out oil filter housing.



Installing

Installation is carried out in the reverse order; note the following:

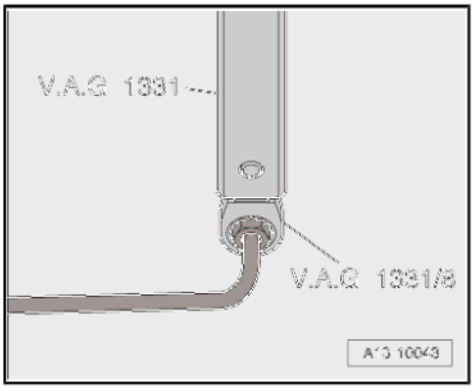
Note

Renew gaskets, seals and O-rings.

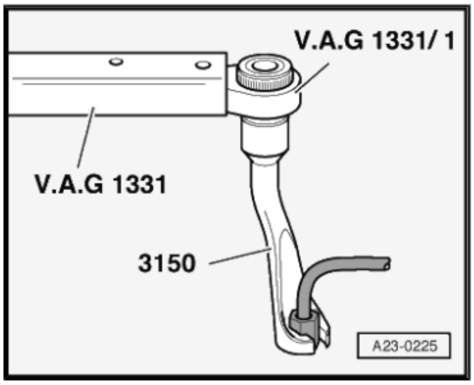
- Install intake manifold (top section) ⇒ Rep. gr. 23 .
- Tighten union nuts on high-pressure pipes hand-tight initially.
- Ensure that high-pressure pipes are not under tension.

Vehicles up to 08.2005:

- To tighten union of high-pressure pipe at high-pressure pump, use torque wrench -V.A.G 1331- with socket insert AF 14, flared ring spanner -V.A.G 1331/8- .

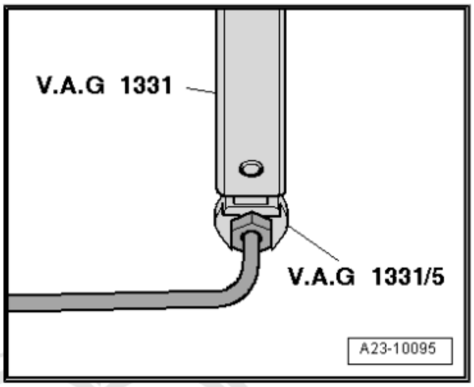


- To tighten unions of high-pressure pipes at rail elements, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket, 14 mm -3150- .

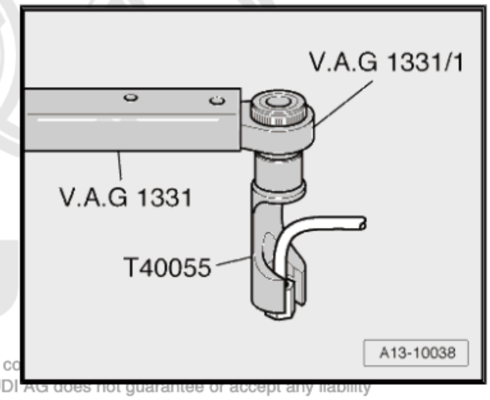


Vehicles from 08.2005 onwards:

- To tighten unions of high-pressure pipes at rail elements, use torque wrench -V.A.G 1331- with tool insert, AF 19 -V.A.G 1331/5- .



- To tighten union of high-pressure pipe at high-pressure pump, use torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1- and socket -T40055- , 17 mm.



All vehicles:

- Check fuel system for leaks ⇒ Rep. gr. 23 .

Tightening torques

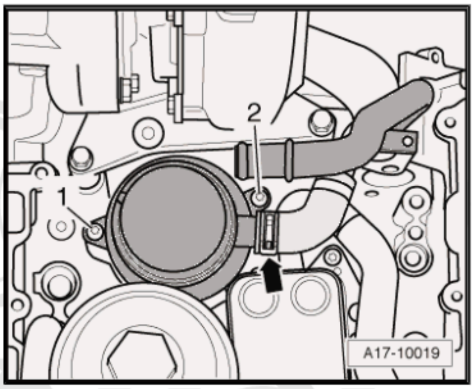
Component	Nm
Oil filter housing to mounting plate	9
Oil supply line to mounting plate	9
Sealing cap on oil filter housing	35
High-pressure pipes	25

1.9 Removing and installing pressure control valve for crankcase breather system

Removing

- Drain off coolant ⇒ page 202 .
- Remove intake manifold (top section) ⇒ Rep. gr. 23 .
- Remove bottom section of intake manifold (left or right) ⇒ Rep. gr. 23 .
- Remove exhaust gas recirculation cooler ⇒ page 301 .

- Detach hose -arrow- from pressure control valve for crankcase breather system.
- Remove bolts -1- and -2-.
- Take out pressure control valve for crankcase breather system.



Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

- Install exhaust gas recirculation cooler ⇒ page 301 .
- Install bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .
- Install intake manifold (top section) ⇒ Rep. gr. 23 .
- Fill cooling system ⇒ page 204 .

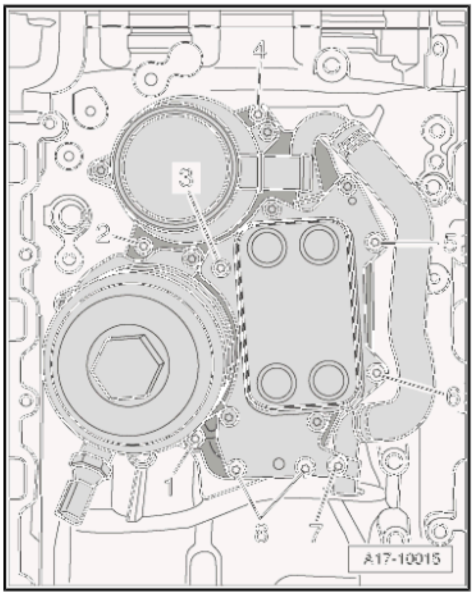
Tightening torque

Component	Nm
Pressure control valve for crankcase breather system to mounting plate	9

1.10 Removing and installing mounting plate for oil cooler, pressure control valve and oil filter housing

Removing

- Drain off coolant ⇒ page 202 .
- Move lock carrier to service position ⇒ page 43 .
- Remove intake manifold (top section) ⇒ Rep. gr. 23 .
- Remove bottom section of intake manifold (left or right) ⇒ Rep. gr. 23 .
- Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Remove high-pressure pump ⇒ Rep. gr. 23 .
- Remove exhaust gas recirculation cooler ⇒ page 301 .



- Remove bolts -1 ... 8-.
- Take out mounting plate with oil cooler, pressure control valve and oil filter housing

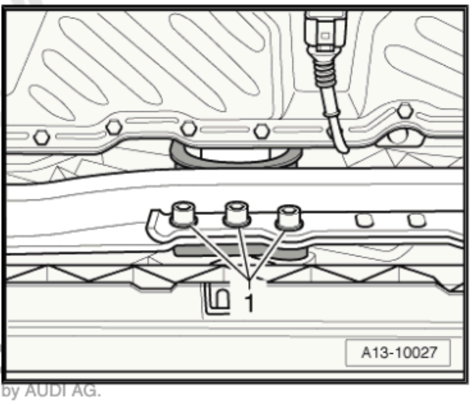
Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets, seals and O-rings.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Tighten bolts securing mounting plate from the inside outwards.
- Install exhaust gas recirculation cooler ⇒ page 301 .
- Install high-pressure pump ⇒ Rep. gr. 23 .
- Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Install bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .
- Install intake manifold (top section) ⇒ Rep. gr. 23 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Fill up with engine oil and check oil level ⇒ page 200 .
- Fill cooling system ⇒ page 204 .

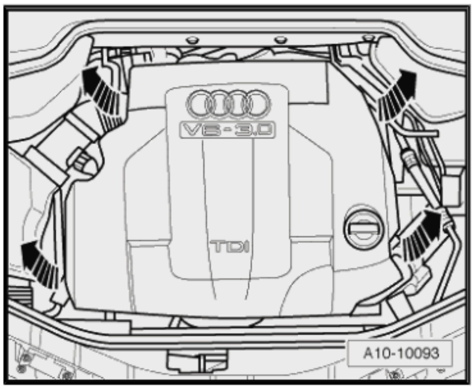
Tightening torques

Component		Nm
Mounting plate to cylinder block		9
Torque reaction support bracket to air pipe (bottom)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

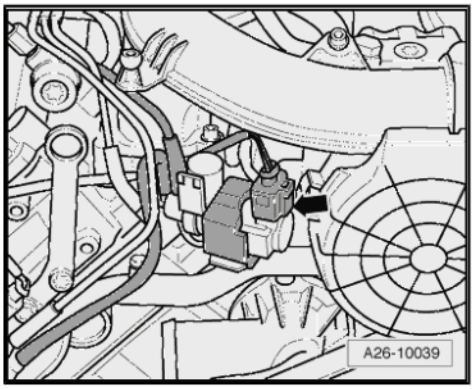
1.11 Removing and installing oil pressure switch -F1-

Removing

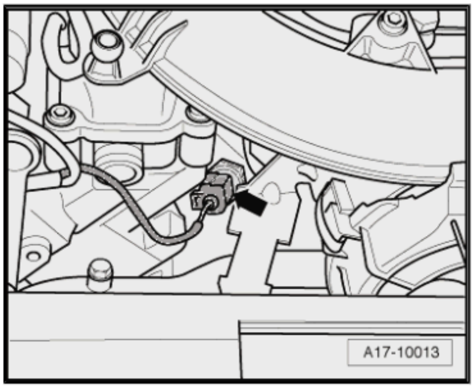
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



- Detach exhaust gas recirculation valve -N18- -arrow- from retainer.



- Unplug electrical connector -arrow-.
- Unscrew oil pressure switch -F1- .



Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seal.

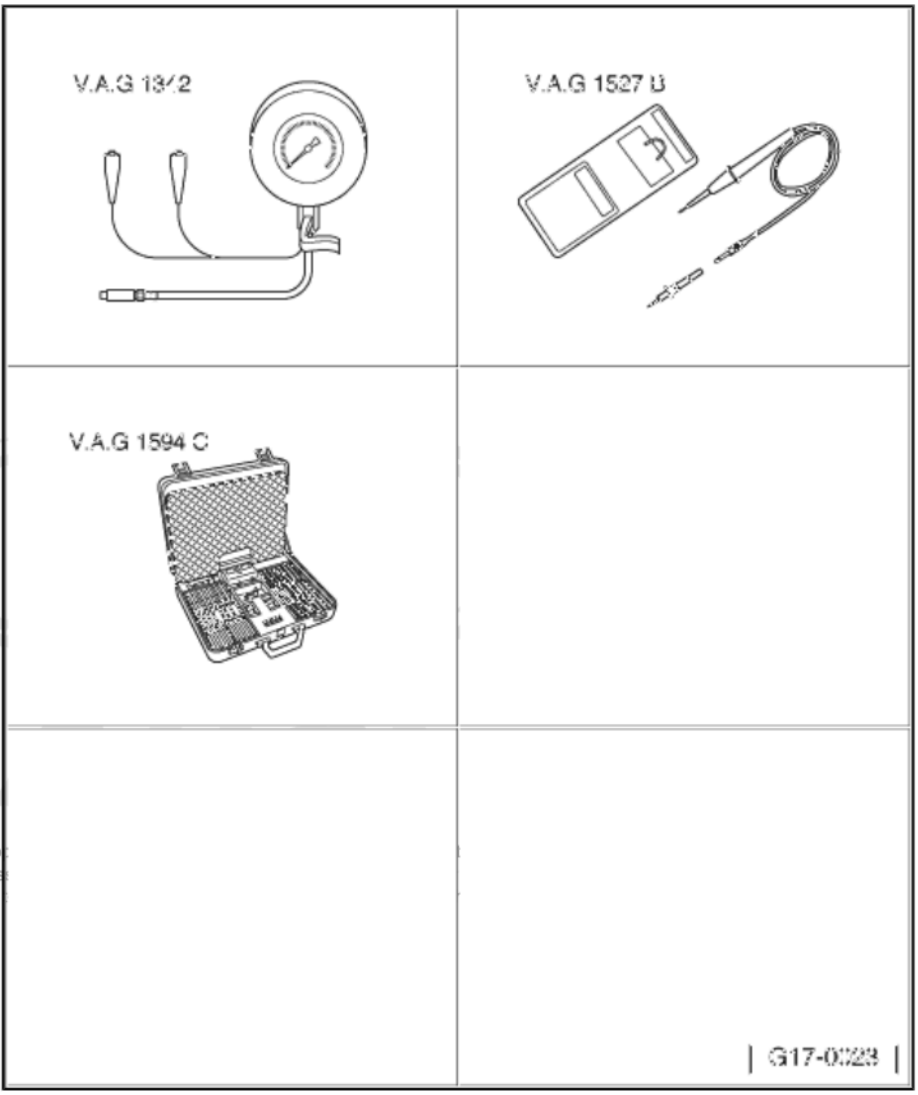
Tightening torque

Component	Nm
Oil pressure switch to engine	20

1.12 Checking oil pressure switch and oil pressure

Special tools and workshop equipment required

- ◆ Oil pressure tester -V.A.G 1342-
- ◆ Voltage tester -V.A.G 1527B-
- ◆ Auxiliary measuring set -V.A.G 1594C-

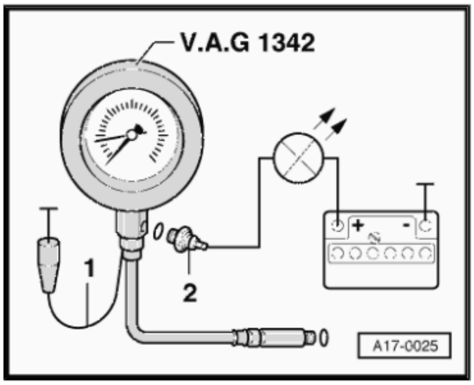


Procedure

- Oil level OK
- Engine oil temperature approx. 80 °C

– Remove oil pressure switch ⇒ page 198 .

- Connect oil pressure tester -V.A.G 1342- to threaded hole for oil pressure switch.
- Screw oil pressure switch -2- into oil pressure tester -V.A.G 1342- .



Checking oil pressure switch

- Connect brown wire -1- of oil pressure tester to earth (–).
- Connect voltage tester -V.A.G 1527B- with test leads from auxiliary measuring set -V.A.G 1594C- to oil pressure switch and battery positive (+).

- LED should not light up.

If LED lights up now:

- Renew oil pressure switch.
- Start engine.

Note

Observe tester and LED while starting, as switching point of oil pressure switch may already be exceeded when starting.

- LED should light up at 0.7 ... 1.1 bar.

If LED does not light up:

- Renew oil pressure switch.

Checking oil pressure

- Start engine.

- Minimum oil pressure at idling speed: 1.8 bar
- Minimum oil pressure at 2000 rpm: 4.0 bar

Assembling

- Install oil pressure switch ⇒ page 198 .

1.13 Engine oil

Refer to ⇒ Maintenance tables for engine oil capacity, oil specifications and viscosity grades.

1.14 Checking oil level

Procedure

- Engine oil temperature at least 60 °C.
- Vehicle must be level (horizontal)
- Wait a few minutes after switching off the engine to allow the oil to flow back into the sump.

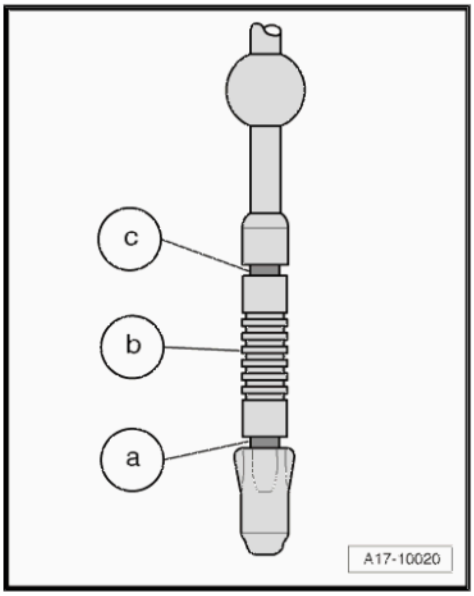
- Pull out the dipstick, wipe off with a clean cloth and insert it again as far as it will go.
- Pull out the dipstick again and read off the oil level.

Markings on oil dipstick:

a - Oil must be topped up. It is sufficient if the oil level is somewhere in area -b- (grooved area on dipstick) after topping up.

b - Oil may be topped up.

c - Do not top up oil.



19 – Cooling

1 Removing and installing parts of cooling system

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

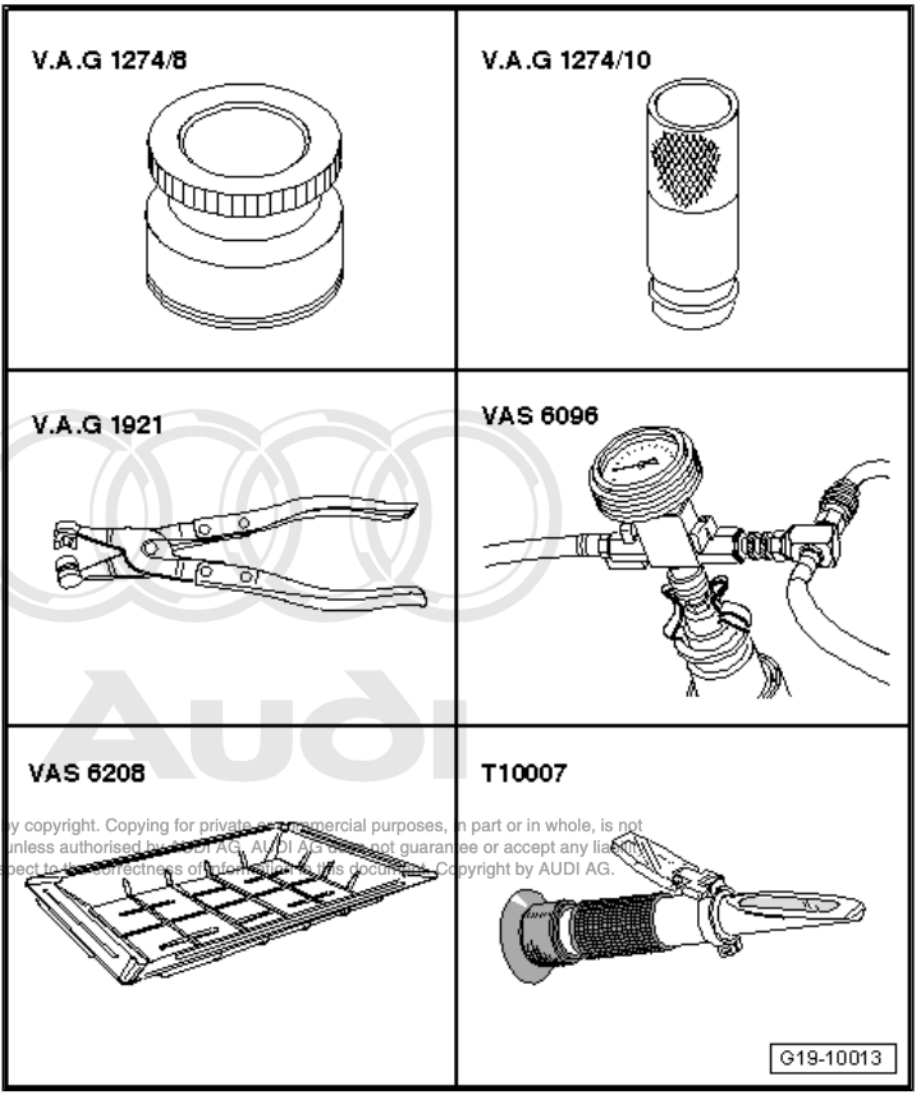
Note

- *The cooling system is under pressure when the engine is hot. If necessary, relieve pressure before commencing repair work.*
- *The arrow markings on coolant pipes and on ends of hoses must align.*

1.1 Draining and filling cooling system

Special tools and workshop equipment required

- Adapter for cooling system tester -V.A.G 1274/8-
- Pipe for cooling system tester -V.A.G 1274/10-
- Hose clip pliers - V.A.G 1921-
- Cooling system charge unit -VAS 6096-
- Drip tray for workshop hoist -VAS 6208-
- Refractometer -T10007-



Draining

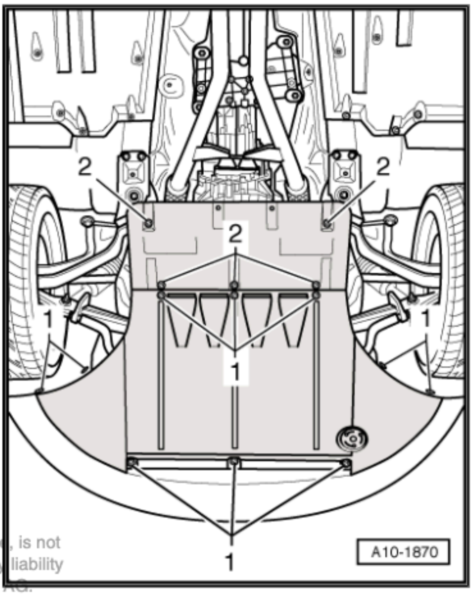
Note

Collect drained coolant in a clean container for re-use or disposal.

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Open quick-release fasteners -1- and remove noise insulation (front).
- Place drip tray for workshop hoist -VAS 6208- under engine.



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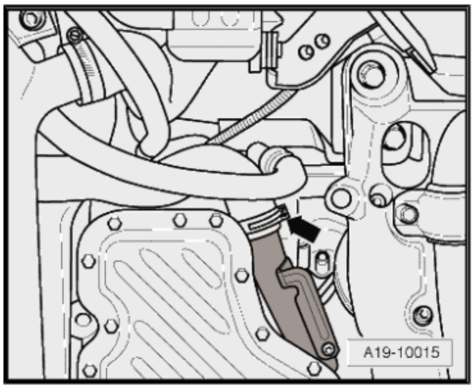
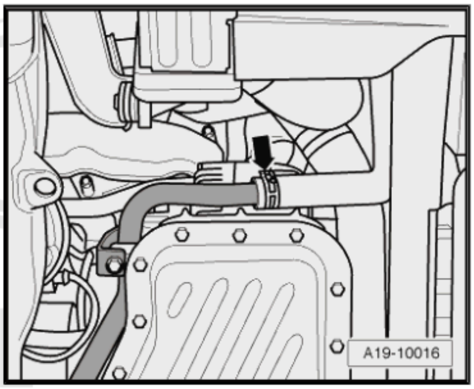
- Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.



– Disconnect coolant hose -arrow- from coolant pipe (right-side) and drain off remaining coolant from engine.



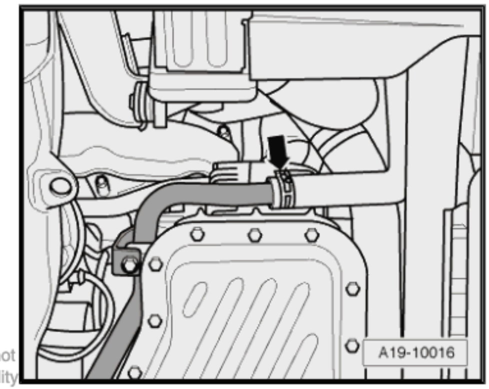
Filling

- Ignition off.

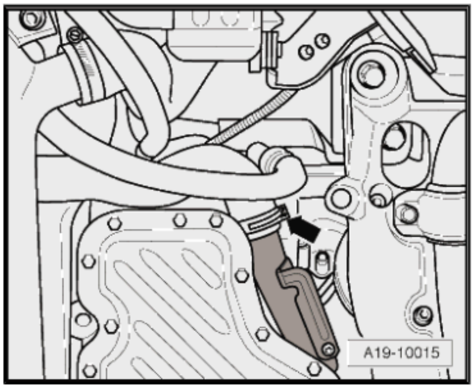
Note

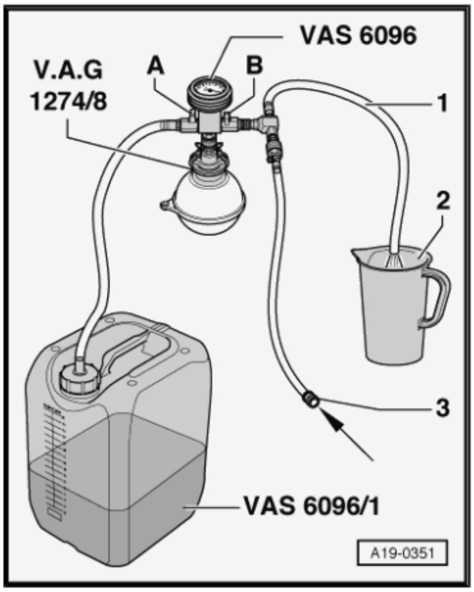
- *The cooling system is filled all year round with a mixture of water and radiator antifreeze/anti-corrosion agent.*
- *It is important to use only coolant additive Plus -G 012 A8F A1- (also designated as »G12+«) „meeting specification TL VW 774 F“. Other coolant additives could seriously impair in particular the anti-corrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- *»G12+« and coolant additives marked „Conforming with specification TL VW 774 F“ prevent frost and corrosion damage and stop scale from forming. Such additives also raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct antifreeze and anticorrosion additive.*
- *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *Frost protection is required down to about -25°C (in countries with arctic climate: down to about –35 °C).*
- *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The antifreeze concentration must be at least 40 %.*
- *If greater frost protection is required in very cold climates, the amount of »G12+« can be increased, but only up to 60% (this gives frost protection to about –40 °C). If antifreeze concentration exceeds 60%, frost protection decreases again and cooling efficiency is also impaired.*
- *Use only clean tap water for mixing coolant.*
- *If radiator, heat exchanger, cylinder head, cylinder head gasket or cylinder block have been renewed, do not re-use old coolant.*
- *Contaminated or dirty coolant must not be used again.*
- *To check frost protection level of coolant additive »G12+« you must use a refractometer -T10007- .*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Renew seal.*

- Fit coolant hose -arrow- onto coolant pipe (right-side).



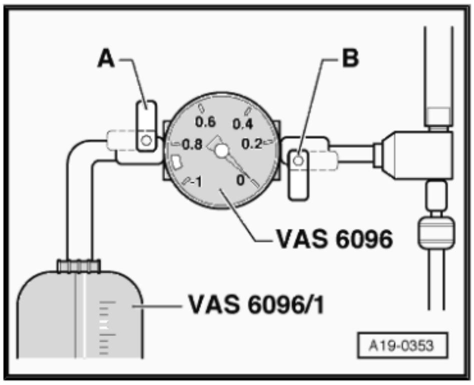
- Fit coolant hose -arrow- onto coolant pipe (left-side).





- Fill reservoir of -VAS 6096- with at least 14 litres of premixed coolant (according to recommended ratio):
- »G12+« (40 %) and water (60 %) for frost protection to –25 ° C
- »G12+« (50 %) and water (50 %) for frost protection to –35 ° C
- »G12+« (60 %) and water (40 %) for frost protection to –40 ° C
- Screw adapter -V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit -VAS 6096- to adapter -V.A.G 1274/8- .
- Run vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)
- Close the two valves -A- and -B- by setting lever at right angle to direction of flow.
- Connect hose -3- to compressed air.
- Pressure: 6 ... 10 bar.

– Open valve -B- by setting lever in direction of flow.



The suction jet pump generates a partial vacuum in the cooling system.

- The needle on the gauge should move into the green zone.

– Also briefly open valve -A- (turn lever in direction of flow) so that hose on charge unit reservoir -VAS 6096- can fill with coolant.

– Close valve -A- again.

– Leave valve -B- open for another 2 minutes.

- The suction jet pump will continue generating a vacuum in the cooling system.

- The needle on the gauge should remain in the green zone.

– Close valve -B-.

- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

If the needle does not reach the green zone, repeat the process.

If the vacuum level drops, there is a leak in the cooling system.

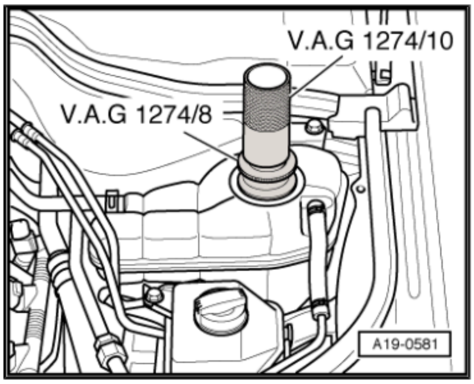
– Detach compressed air hose.

– Open valve -A-.

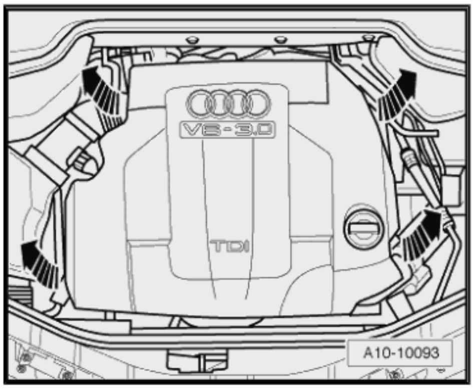
The vacuum in the cooling system causes the coolant to be drawn out of the reservoir for cooling system charge unit -VAS 6096-, the cooling system is then filled.

– Detach cooling system charge unit -VAS 6096- from expansion tank.

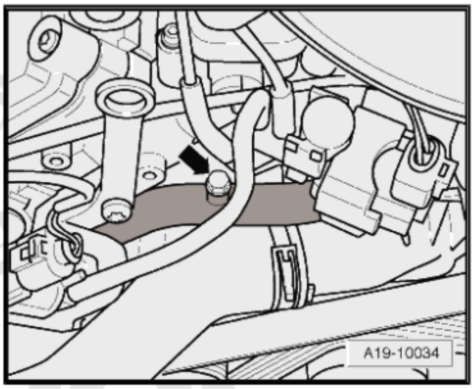
– Fit pipe -V.A.G 1274/10- onto adapter -V.A.G 1274/8- .



– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



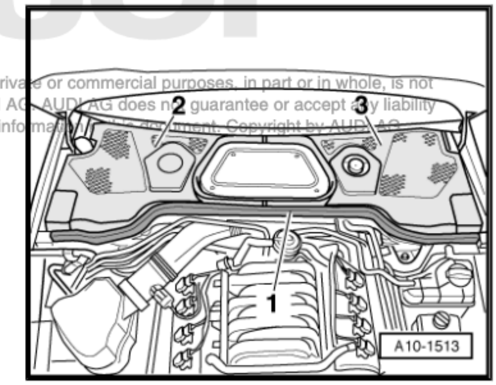
- Unscrew bleeder screw -arrow- at front of engine.
- Fill up with coolant until it comes out at bleeder hole with no air bubbles.
- Close bleeder screw.
- If fitted, unscrew bleeder screw on radiator and fill up with coolant until it comes out at bleeder screw.



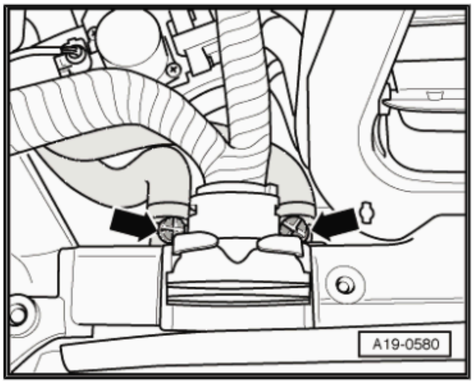
- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber cover -2-.

Note

Disregard -item 3-.



- Open bleeder screws -arrows-.
- Fill up with coolant until it flows out at bleeder holes in coolant hoses.
- Close the bleeder screws.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Tighten filler cap on expansion tank.
- Start engine.
- Set heater/air conditioner on both sides to „HI“.
- Run the engine for 3 minutes at 2000 rpm.
- Allow the engine to run at idling speed until the two large coolant hoses at main radiator become warm.
- Run the engine for 1 minute at 2000 rpm.
- Switch off ignition and allow engine to cool down.

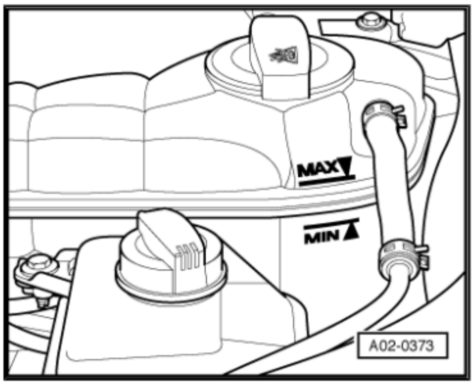


- Check coolant level.

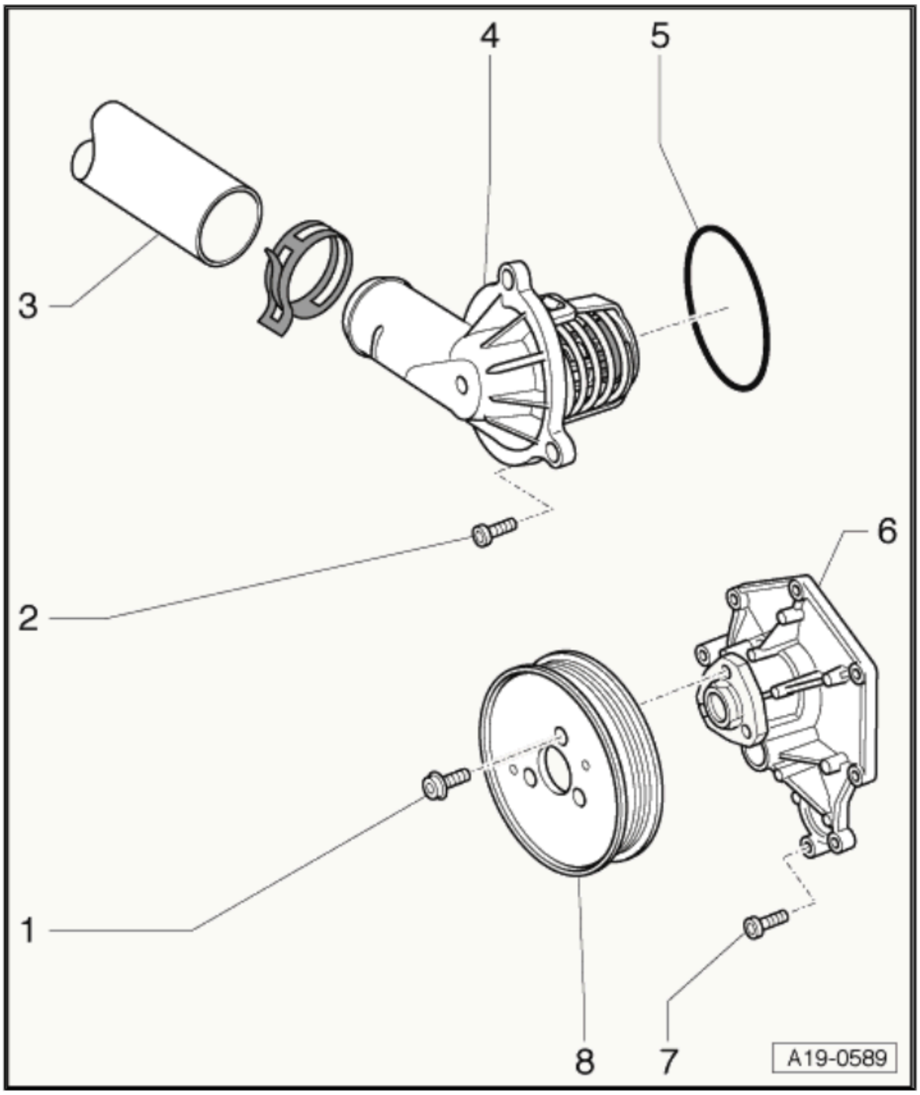
- The coolant level must be at the MAX marking when the engine is cold.
- The coolant level can be above the MAX marking when the engine is warm.

Tightening torque

Component	Nm
Bleeder screw to coolant pipe	8



1.2 Coolant pump and thermostat - exploded view



1 - 23 Nm

2 - 9 Nm

3 - Coolant hose

- ☐ To radiator (top right)

4 - Hose connection with thermostat

- ☐ Removing and installing ⇒ page 209

5 - Seal

- ☐ Renew

6 - Coolant pump

- ☐ Removing and installing ⇒ page 208

7 - 9 Nm

8 - Poly V-belt pulley for coolant pump

- ☐ Installation position: marking „vorne“ (front) faces in direction of travel.

1.3 Removing and installing coolant pump

Removing

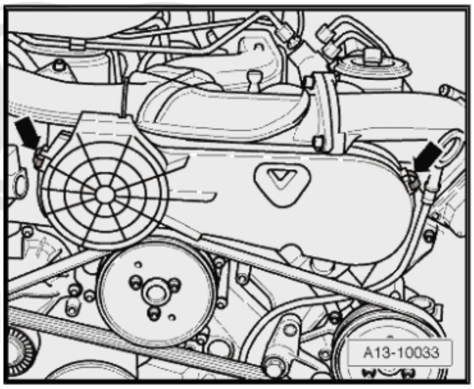
– Drain off coolant ⇒ page 202 .

– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

– Loosen clamps -arrows-.

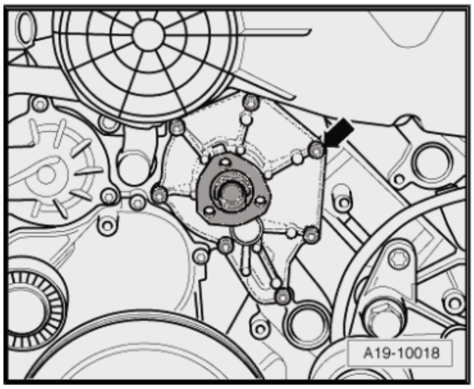
– Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.

– Remove poly V-belt pulley for coolant pump ⇒ page 49 .



Note

Protect poly V-belt from escaping coolant with rags or plastic sheeting.



- Unscrew bolts and take out coolant pump -arrow-.

Installing

Installation is carried out in the reverse order; note the following:

- Clean sealing surface.
- Install poly V-belt pulley for coolant pump ⇒ page 49 .
- Install intake manifold (top section) ⇒ Rep. gr. 23 .
- Fill cooling system ⇒ page 204 .

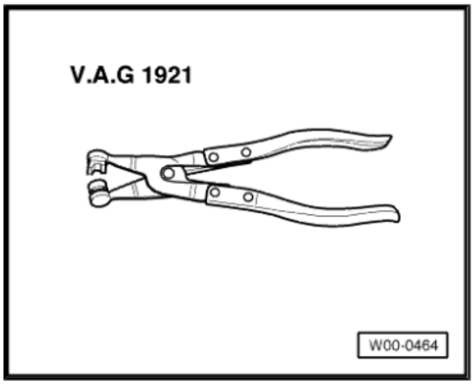
Tightening torque

Component	Nm
Coolant pump to cylinder block	9

1.4 Removing and installing hose connection with thermostat

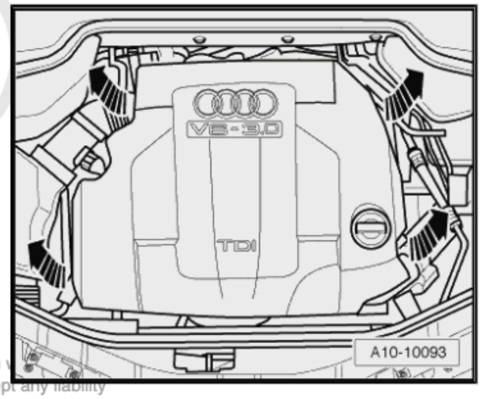
Special tools and workshop equipment required

◆ Hose clip pliers -V.A.G 1921-

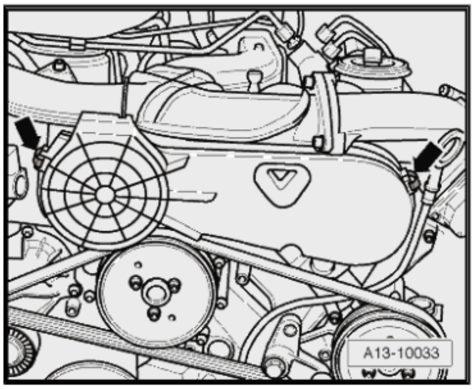


Removing

- Drain off coolant ⇒ page 202 .
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

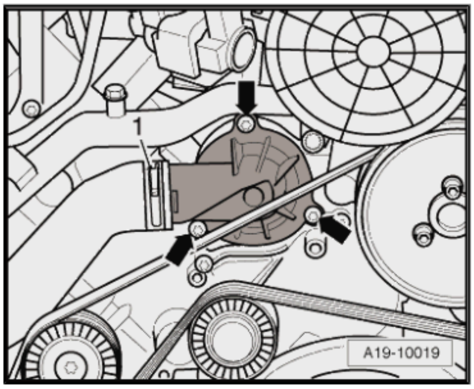


- Loosen clamps -arrows-.
- Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.



Note

Protect poly V-belt from escaping coolant with rags or plastic sheeting.



- Disconnect coolant hose -1-.
- Unscrew bolts -arrows- and take out hose connection with thermostat.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew O-ring.

- Clean sealing surface.
- Fill cooling system ⇒ page 204 .

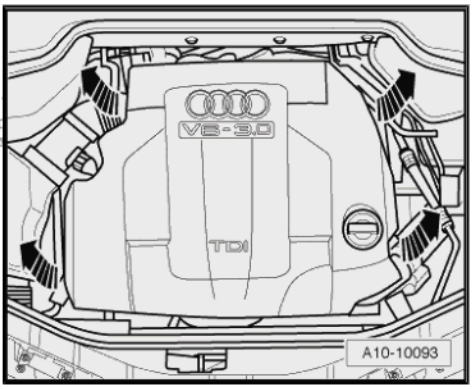
Tightening torques

Component	Nm
Thermostat housing to engine	9

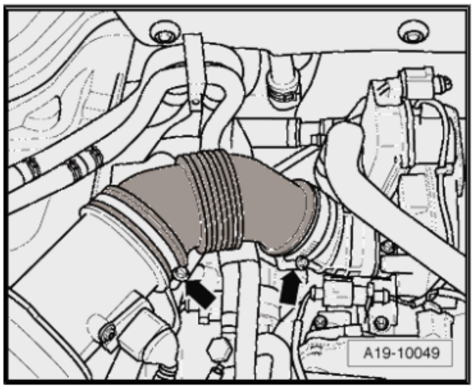
1.5 Removing and installing coolant temperature sender -G62-

Removing

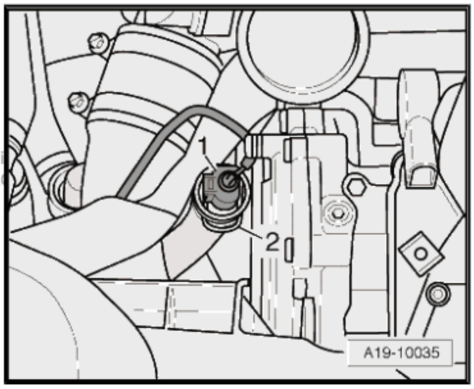
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



- Remove air pipe between turbocharger and air mass meter -G70- -arrows-.



- Unplug electrical connector -1- at coolant temperature sender -G62- .



Note

Place a cloth underneath to catch any escaping coolant.

- Pull off retaining clip -2- and detach coolant temperature sender -G62- .

Installing

Installation is carried out in the reverse order; note the following:

Note

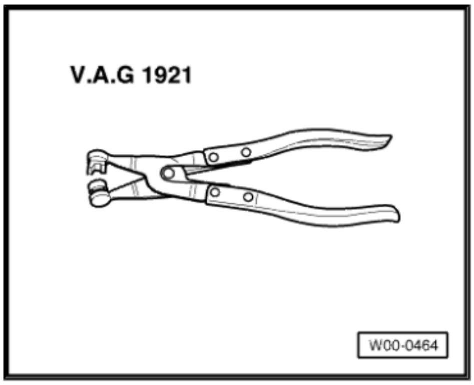
Renew O-ring.

- Fill cooling system ⇒ page 204 .

1.6 Removing and installing coolant pipe (front)

Special tools and workshop equipment required

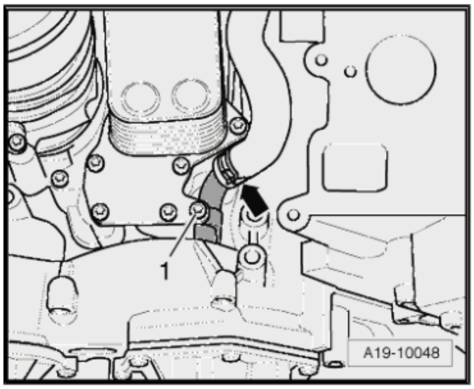
- ♦ Hose clip pliers -V.A.G 1921-



Removing

- Drain off coolant ⇒ page 202 .
- Move lock carrier to service position ⇒ page 43 .
- Remove intake manifold (top section) ⇒ Rep. gr. 23 .
- Remove bottom section of intake manifold (left-side) ⇒ Rep. gr. 23 .
- Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

- Remove high-pressure pump ⇒ Rep. gr. 23 .
- Remove mechanical exhaust gas recirculation valve ⇒ page 301 .
- Disconnect coolant hose -arrow-.
- Unscrew bolt -1- and pull coolant pipe (top) out of cylinder block.



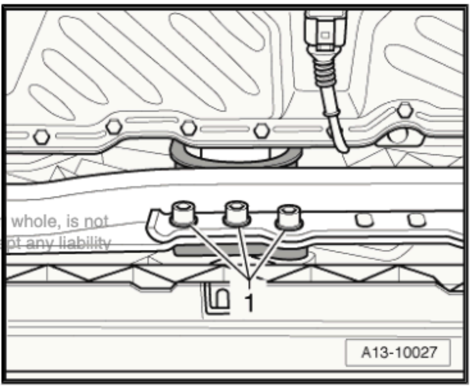
Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew O-ring.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate new O-ring with »G12+« and slide onto coolant pipe.
- Install mechanical exhaust gas recirculation valve ⇒ page 301 .
- Install high-pressure pump ⇒ Rep. gr. 23 .
- Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Install bottom section of intake manifold (left-side) ⇒ Rep. gr. 23 .
- Install intake manifold (top section) ⇒ Rep. gr. 23 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Fill cooling system ⇒ page 204 .

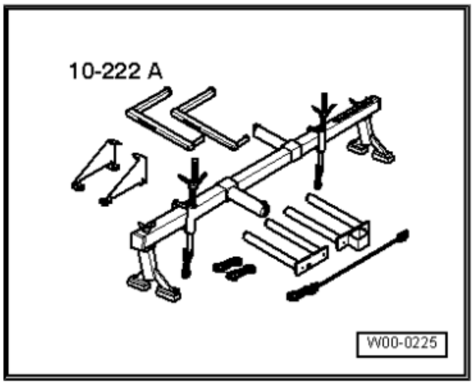
Tightening torques

Component		Nm
Front coolant pipe to oil cooler		9
Torque reaction support bracket to air pipe (bottom)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

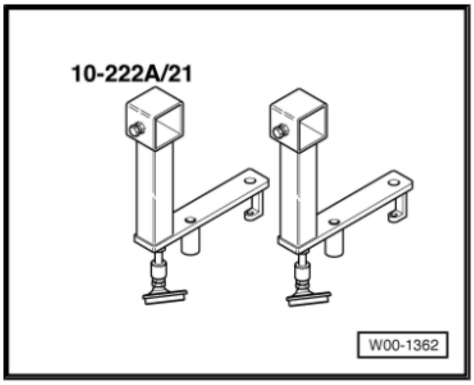
1.7 Removing and installing coolant pipe (left-side)

Special tools and workshop equipment required

- Support bracket -10 - 222 A-



- Adapter -10 - 222 A /21-



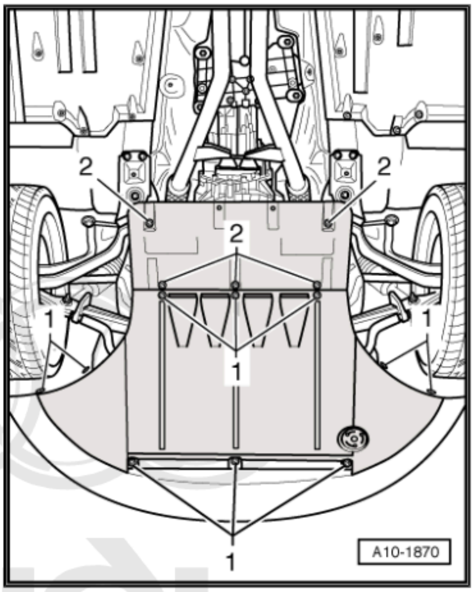
Removing

– Remove front left wheel.

Note

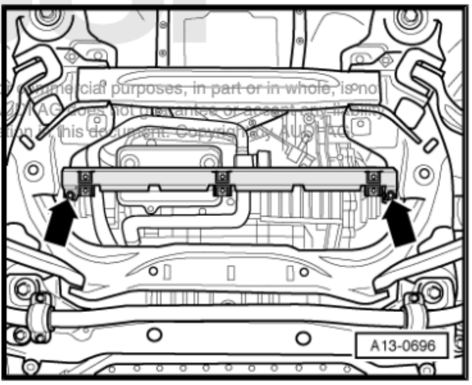
Secure brake disc with wheel bolts.

– Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.

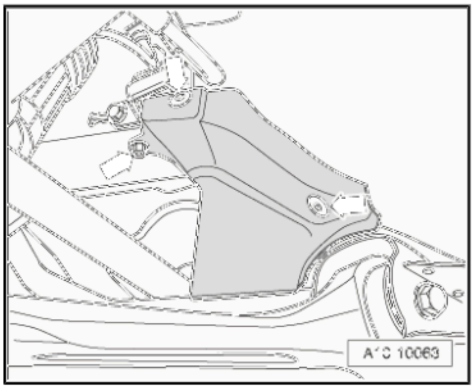


– Unbolt bracket for noise insulation -arrows-.

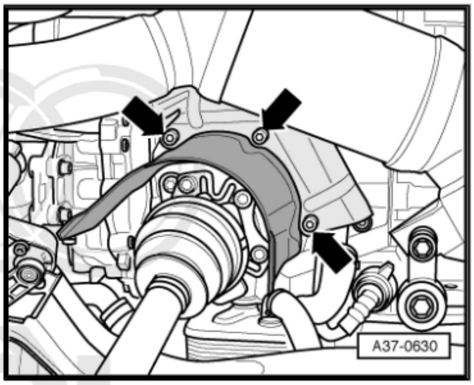
– Drain off coolant ⇒ page 202 .



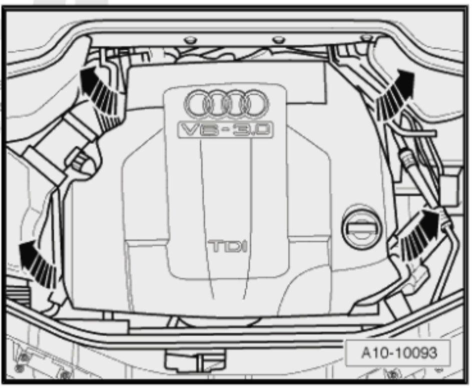
- Remove noise insulation in left-side wheel housing -arrows-.



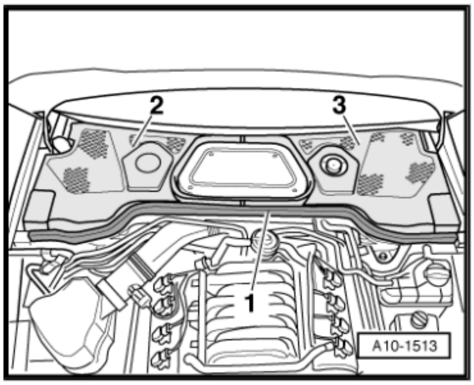
- Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.



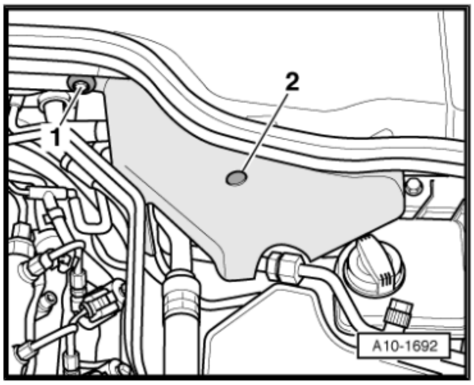
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.



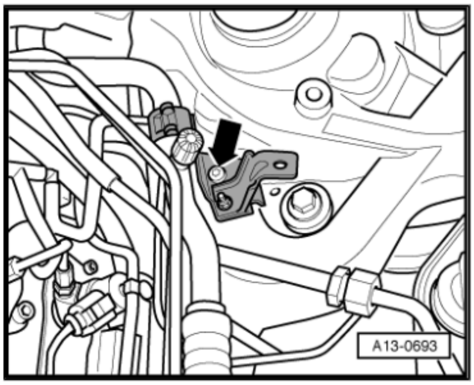
- Remove cover for suspension turret (left-side); to do so, remove nut -1- and detach spreader clip -2-.



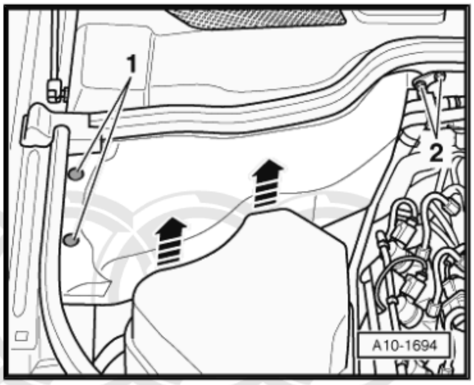
- Remove bolt -arrow-.
- Pivot bracket for air conditioner pipe to one side.

Note

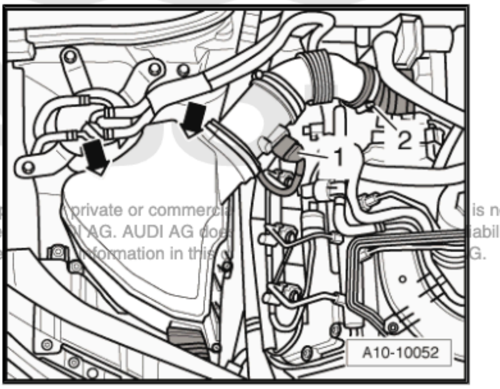
To prevent damage to the refrigerant lines, ensure that the pipes and hoses are not stretched, kinked or bent.



- Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- Pull cover out of retainers -arrows-.



- Detach air intake hose -2- at turbocharger.
- Detach electrical connector at air mass meter -G70- .
- Remove bolts -arrows-.
- Take out air cleaner housing.



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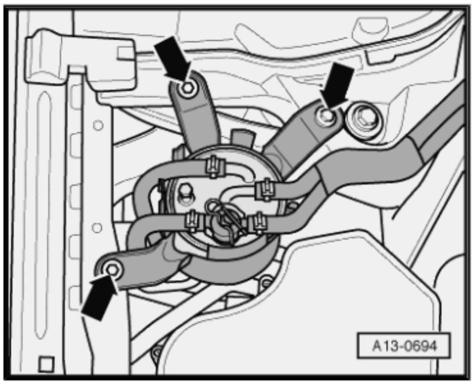
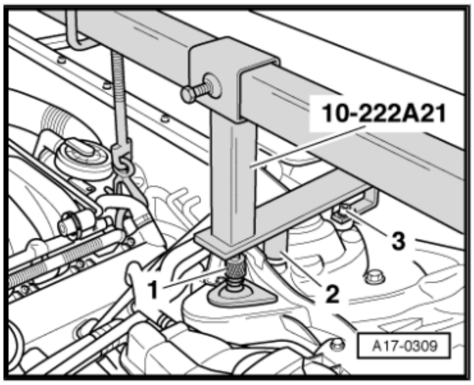
- Remove bolts -arrows- on fuel filter bracket.



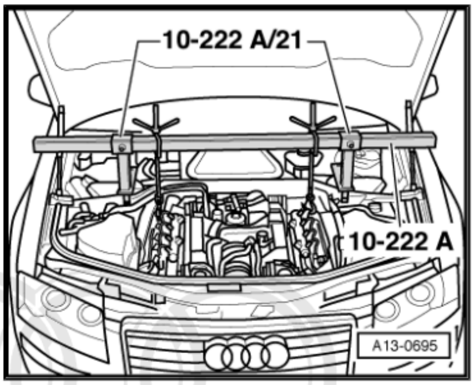
Note

Fuel filter remains in engine compartment with fuel lines connected.

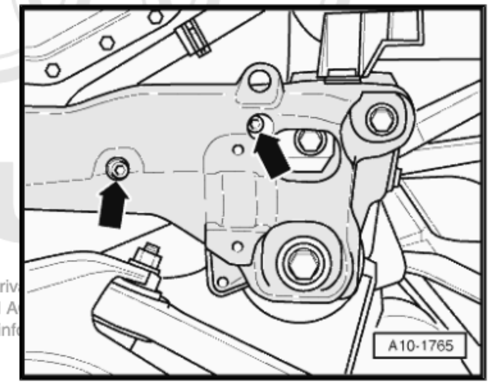
- Unscrew rear bolts -3- for body brace.
- Attach support bracket -10 - 222 A- with adapters -10 - 222 A / 21- onto suspension turrets.
- Supports are marked for left and right side of vehicle.
- The centre resting point -2- of supports is positioned on front bolts for body brace.
- The adapters -10 - 222 A /21- are attached by means of the rear securing bolts -3- for the body brace.
- The knurled screw -1- must be screwed down until support plate rests on suspension turret.



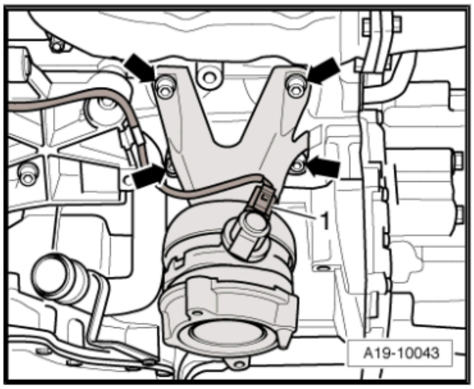
- Secure spindles of support bracket -10 - 222 A- to rear engine lifting eyes.
- Partly take up weight of engine with spindles of support bracket.



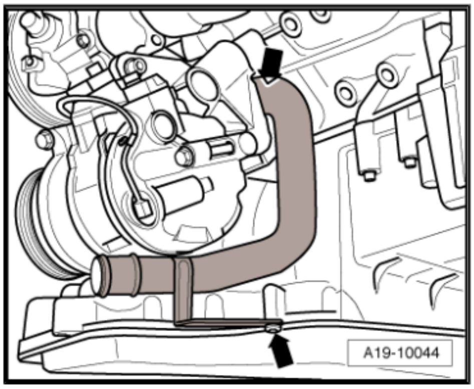
- Remove bolts -arrows- for engine mounting (left-side)



- Unplug electrical connector -1- at engine mounting (left-side).
- Unscrew bolts -arrows- and remove engine support (left-side).



- Remove bolts -arrows- and take off coolant pipe (left-side).



Installing

Installation is carried out in the reverse order; note the following:

Note

Renew O-ring.

- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate new O-ring with »G12+« and slide onto coolant pipe.
- Fill cooling system ⇒ page 204 .

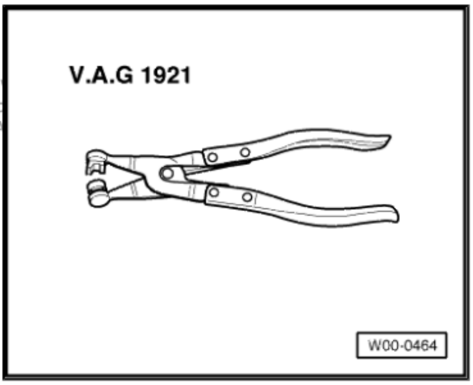
Tightening torques

Component	Nm
Coolant pipe (left-side) to top section of sump and bracket for ancillaries	9
Engine support to cylinder block	40
Engine mounting to engine cross member	23
Bracket for noise insulation to subframe	9
Heat shield for drive shaft	23
Fuel filter bracket to bodywork	10
Bracket for air conditioner pipes to body	9

1.8 Removing and installing coolant pipe (top right)

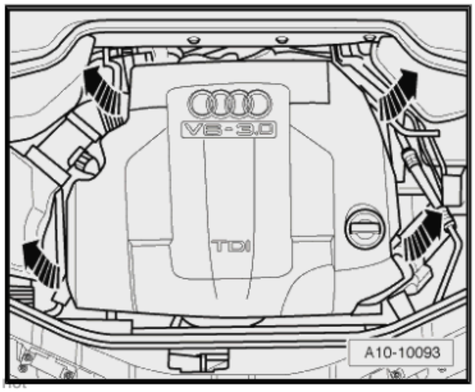
Special tools and workshop equipment required

- Hose clip pliers -V.A.G 1921-

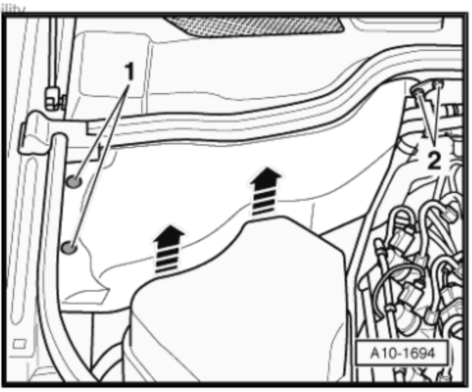


Removing

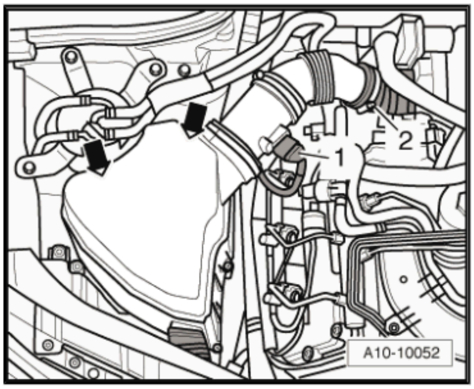
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.
- Drain off coolant ⇒ page 202 .



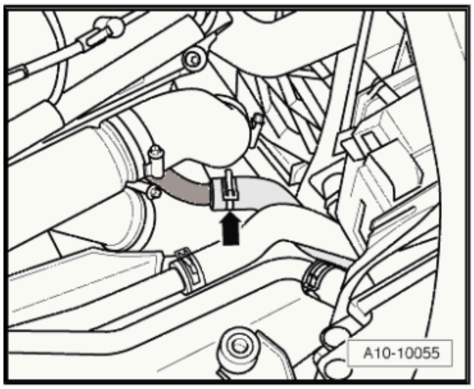
- Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- Pull cover out of retainers -arrows-.



- Detach air intake hose -2- at turbocharger.
- Detach electrical connector at air mass meter -G70- .
- Remove bolts -arrows-.
- Take out air cleaner housing.



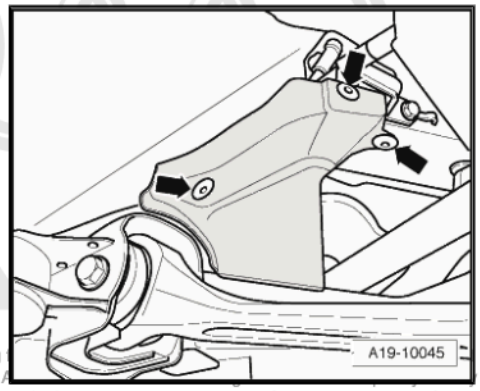
- Detach coolant hose (right-side) -arrow- at engine.
- Remove front right wheel.



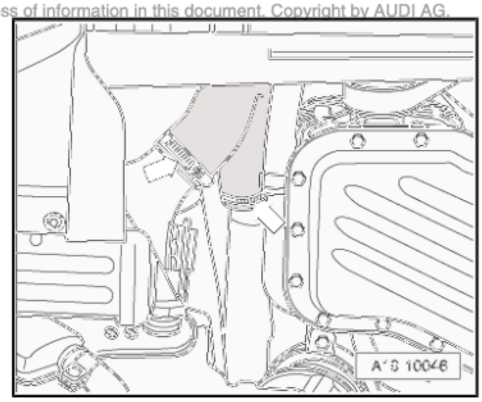
Note

Secure brake disc with wheel bolts.

- Remove noise insulation in right-side wheel housing -arrows-.
- Unbolt drive shaft (right-side) from gearbox flange.



- Remove front air intake hose between charge air cooler (right-side) and air pipe (right-side) -arrows-.

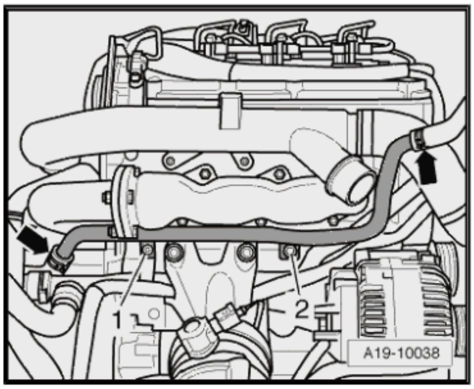


- Disconnect coolant hose -left arrow- from coolant pipe.

Note

Disregard -arrow- on right-side of illustration.

- Remove bolts -1- and -2- and take off coolant pipe (top right).



Installing

Installation is carried out in the reverse order; note the following:

Note

- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Install drive shaft (right-side) ⇒ Rep. gr. 40 .
- Fill cooling system ⇒ page 204 .

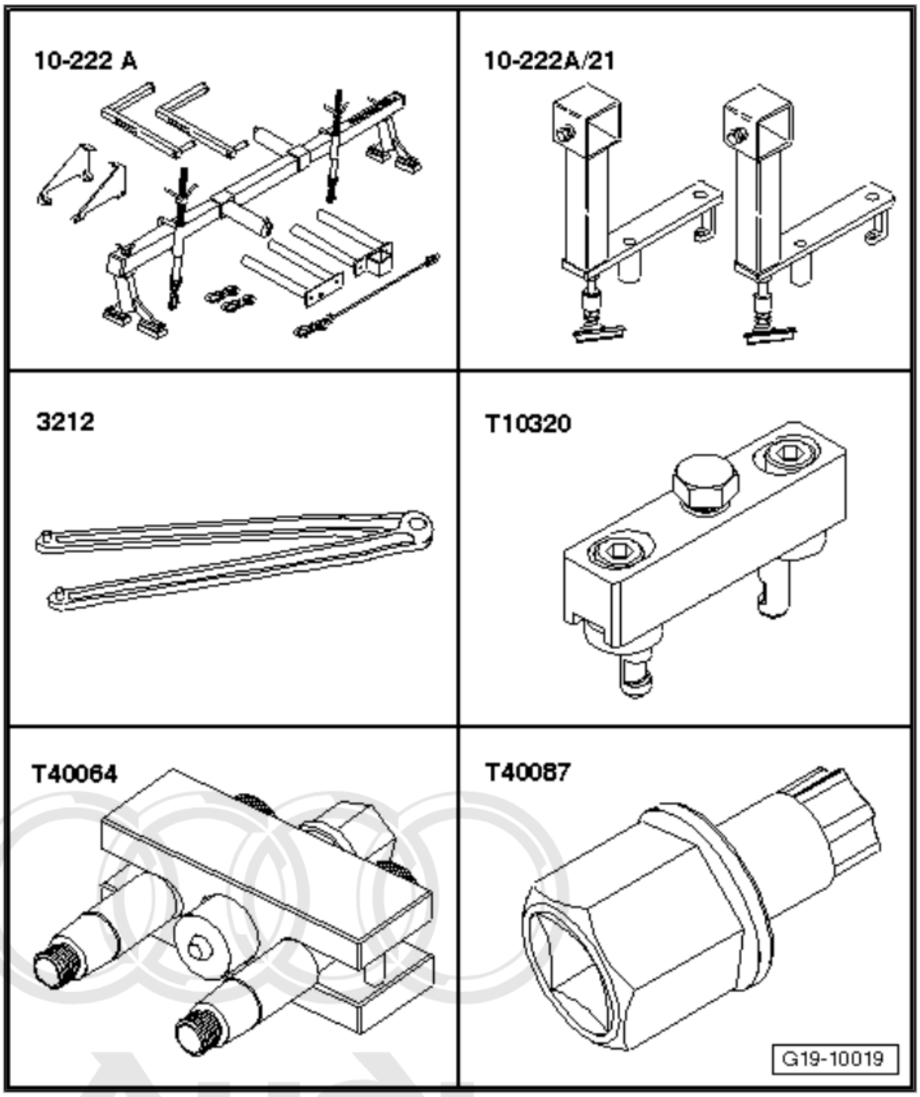
Tightening torques

Component		Nm
Coolant pipe to engine	M6	9
	M8	22
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.9 Removing and installing coolant pipe (centre right)

Special tools and workshop equipment required

- Support bracket -10 - 222 A-
- Adapter -10 - 222 A /21-
- Pin wrench -3212-
- Puller -T10320- for vehicles from 03.2006 onwards
- Puller -T40064-
- Socket Torx T 60 -T40087-



Removing

Note

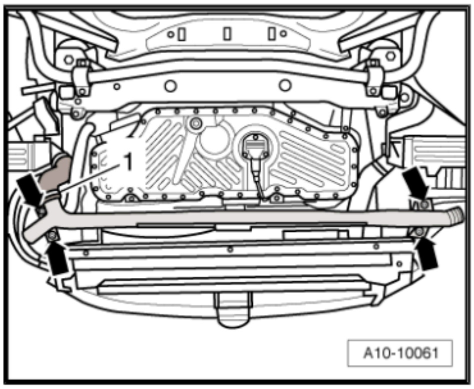
- *All cable ties which are released or cut open when removing must be refitted in the same position when installing.*
- *To make sure you can still move the front wheels when the battery has been disconnected, only disconnect the battery with the ignition key inserted.*

– With ignition switched off, disconnect earth cable at battery ⇒ Rep. gr. 27 .

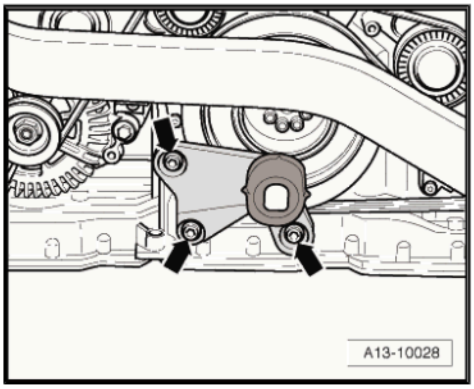
– Drain off coolant ⇒ page 202 .

– Move lock carrier to service position ⇒ page 43 .

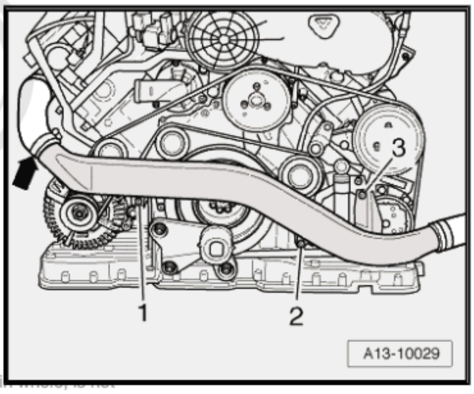
- Disconnect hose -1-.
- Unscrew bolts -arrows- and take out air pipe (bottom).



- Unscrew bolts -arrows- and detach torque reaction support from engine.

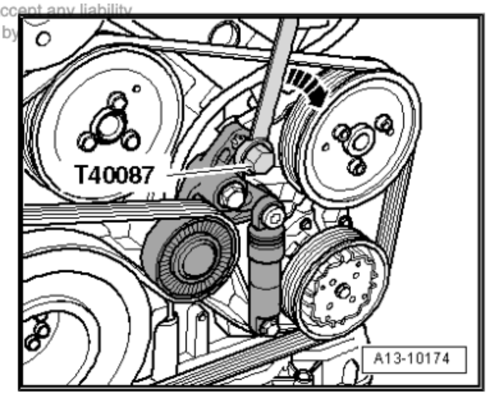


- Disconnect air intake hose -arrow- from air pipe (top).
- Unscrew bolts -1 ... 3- and detach air pipe (top).



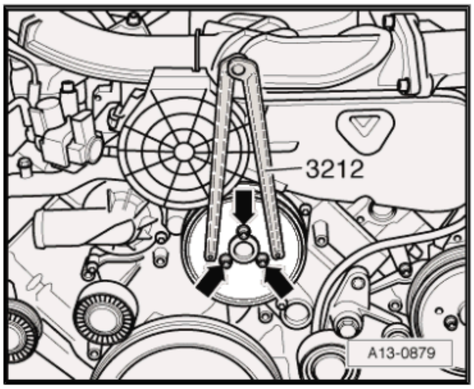
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

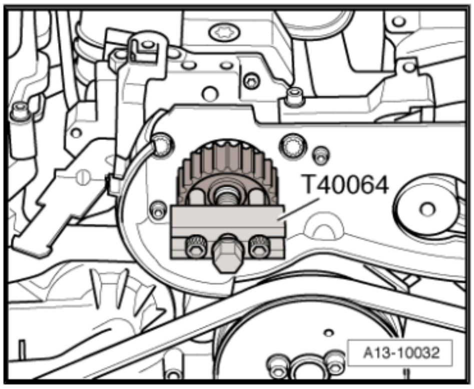


- Slacken poly V-belt by swivelling tensioner in direction of -arrow-, using socket Torx T 60 -T40087- and a long, straight-handled ring spanner or open-end spanner.
- Remove poly V-belt from tensioning roller.

- Counterhold using pin wrench -3212- when loosening bolts -arrows-.
- Take poly V-belt pulley off coolant pump.
- Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

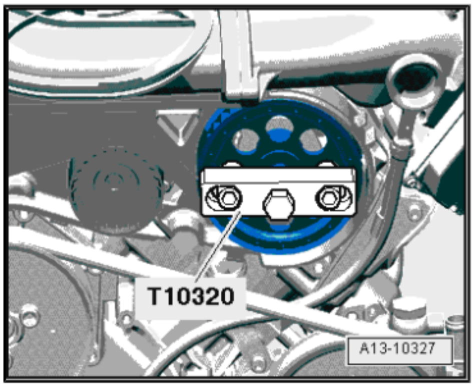


- Use puller -T40064- to pull off toothed belt sprocket.



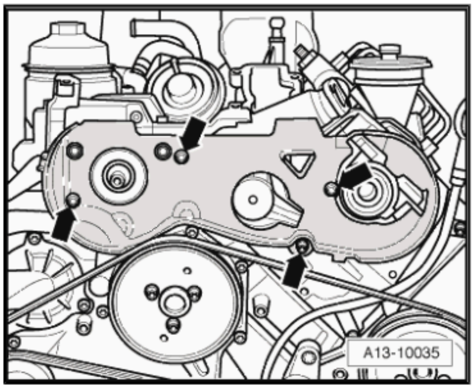
Vehicles from 03.2006 onwards:

- Use puller -T10320- to pull off toothed belt drive sprocket.

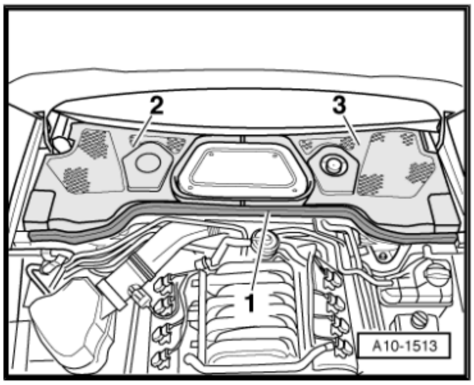


All vehicles:

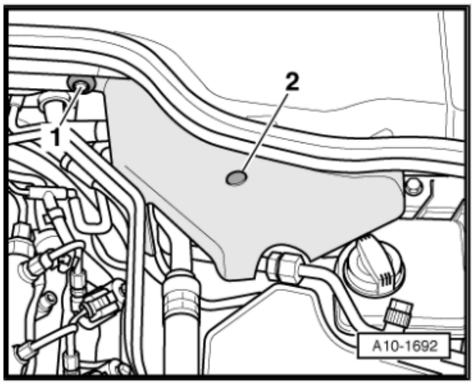
- Remove bolts -arrows- and detach toothed belt cover (rear).



- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.



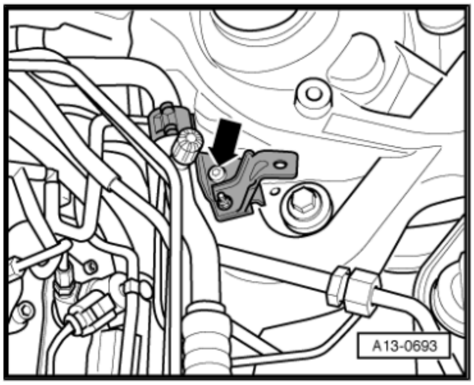
- Remove cover for suspension turret (left-side); to do so, remove nut -1- and detach spreader clip -2-.



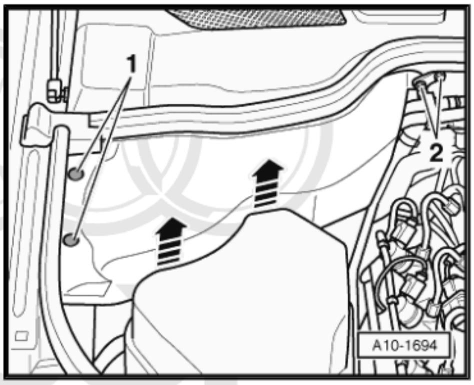
- Remove bolt -arrow-.
- Pivot bracket for air conditioner pipe to one side.

Note

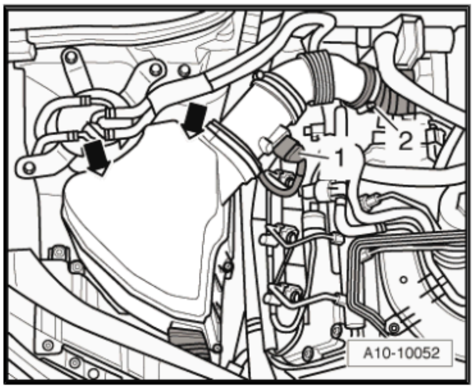
To prevent damage to the refrigerant lines, ensure that the pipes and hoses are not stretched, kinked or bent.



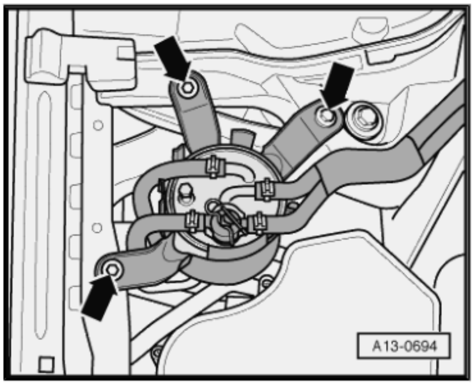
- Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- Pull cover out of retainers -arrows-.



- Detach air intake hose -2- at turbocharger.
- Detach electrical connector at air mass meter -G70- .
- Remove bolts -arrows-.
- Take out air cleaner housing.



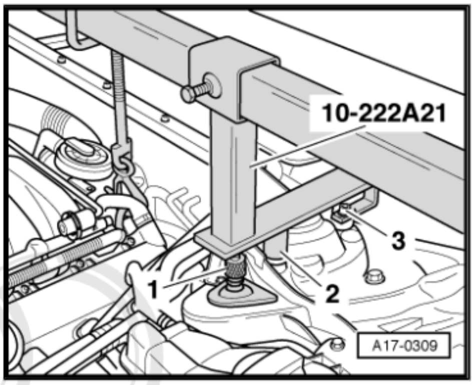
- Remove bolts -arrows- on fuel filter bracket.



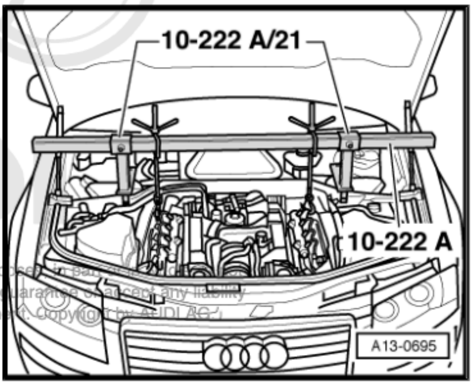
Note

Fuel filter remains in engine compartment with fuel lines connected.

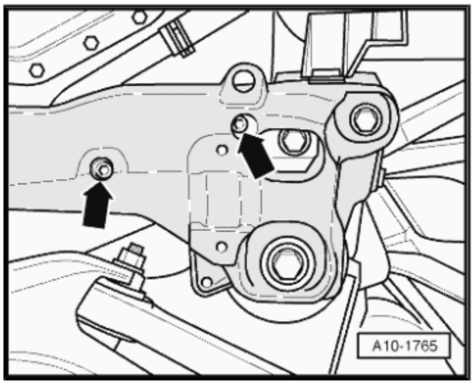
- Unscrew rear bolts -3- for body brace.
- Attach support bracket -10 - 222 A- with adapters -10 - 222 A / 21- onto suspension turrets.
- Supports are marked for left and right side of vehicle.
- The centre resting point -2- of supports is positioned on front bolts for body brace.
- The adapters -10 - 222 A /21- are attached by means of the rear securing bolts -3- for the body brace.
- The knurled screw -1- must be screwed down until support plate rests on suspension turret.



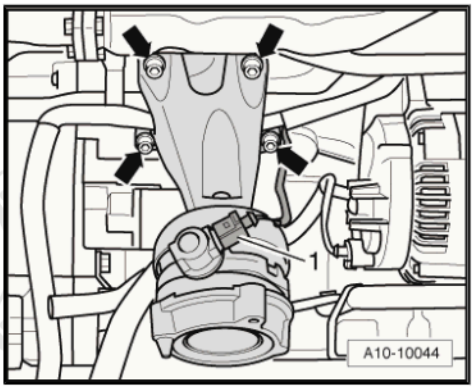
- Secure spindles of support bracket -10 - 222 A- to rear engine lifting eyes.
- Partly take up weight of engine with spindles of support bracket.
- Remove coolant pipe (top right) ⇒ page 217 .



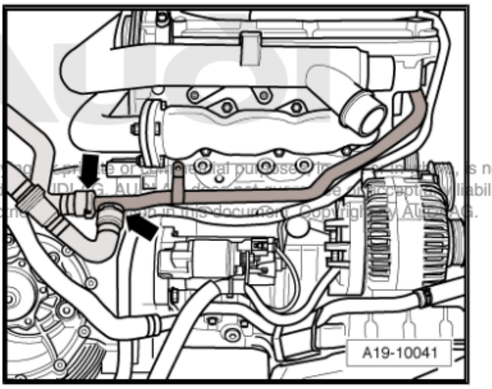
- Remove bolts -arrows- for engine mounting (right-side)



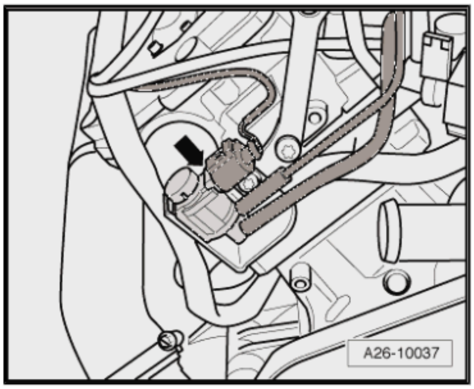
- Unplug electrical connector -1- at engine mounting (right-side).
- Unscrew bolts -arrows- and remove engine support (right-side).

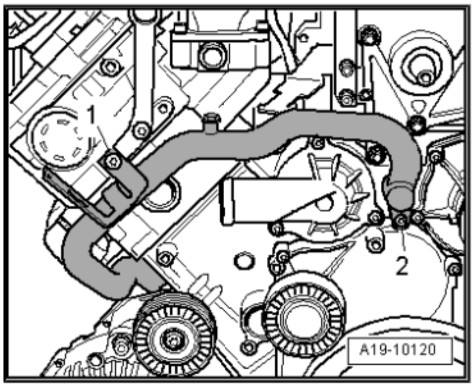


- Move wiring clear of coolant pipe (right-side, centre).
- Disconnect hoses from coolant pipe (right-side, centre) -arrows-.



- Pull change-over valve for exhaust gas recirculation cooler -N345- -arrow- off bracket.





- Remove bolts -1- and -2-.
- Pull coolant pipe (right-side) forwards out of cylinder block and detach coolant pipe.

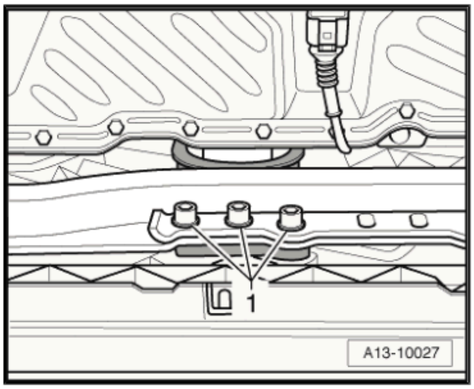
Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew O-rings.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Reinstall all cable ties in the same locations when assembling.*

- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate new O-ring with »G12+« and slide onto coolant pipe.
- Install coolant pipe (top right) ⇒ page 217 .
- Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Install poly V-belt ⇒ page 52 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Observe notes on procedures required after connecting battery ⇒ Rep. gr. 27 .
- Fill cooling system ⇒ page 204 .

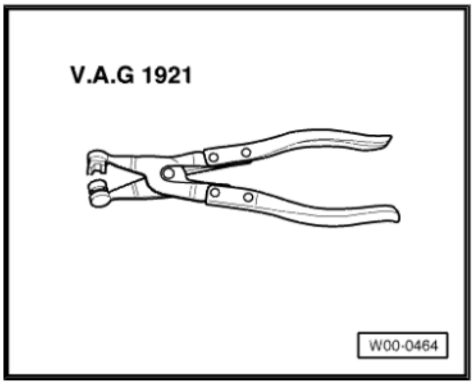
Tightening torques

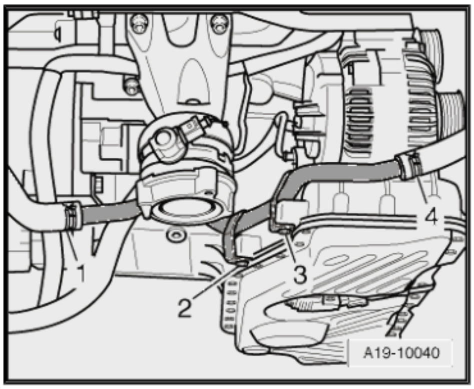
Component	Nm
Coolant pipe (right-side, centre) to cylinder head	9
Engine support to cylinder block	40
Engine mounting to engine cross member	23
Fuel filter bracket to bodywork	9
Bracket for air conditioner pipes to body	9
Toothed belt cover to engine	9
Poly V-belt pulley to coolant pump	22

1.10 Removing and installing coolant pipe (bottom right)

Special tools and workshop equipment required

- Hose clip pliers -V.A.G 1921-





Removing

– Drain off coolant ⇒ page 202 .

– Disconnect hose -1-.

– Remove bolts -2- and -3- and take off coolant pipe (bottom right).

Note

Disregard -item 4-.

Installing

Installation is carried out in the reverse order; note the following:

Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.

– Fill cooling system ⇒ page 204 .

Tightening torque

Component	Nm
Coolant pipe to top section of sump	9

1.11 Removing and installing coolant pipe (top)

Removing

– Drain off coolant ⇒ page 202 .

– Move lock carrier to service position ⇒ page 43 .

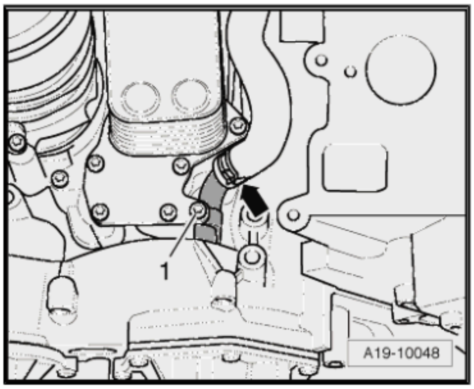
– Remove intake manifold (top section) ⇒ Rep. gr. 23 .

– Remove bottom section of intake manifold (left-side) ⇒ Rep. gr. 23 .

– Remove toothed belt for high-pressure pump ⇒ Rep. gr. 23 .

– Remove high-pressure pump ⇒ Rep. gr. 23 .

– Remove mechanical exhaust gas recirculation valve ⇒ page 301 .



- Disconnect coolant hose -arrow-.
- Unscrew bolt -1- and pull coolant pipe (top) out of cylinder block.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew O-ring.

- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate new O-ring with »G12+« and slide onto coolant pipe.
- Install mechanical exhaust gas recirculation valve ⇒ page 301 .
- Install toothed belt for high-pressure pump ⇒ Rep. gr. 23 .
- Install high-pressure pump ⇒ Rep. gr. 23 .
- Install bottom section of intake manifold (left-side) ⇒ Rep. gr. 23 .
- Install intake manifold (top section) ⇒ Rep. gr. 23 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .

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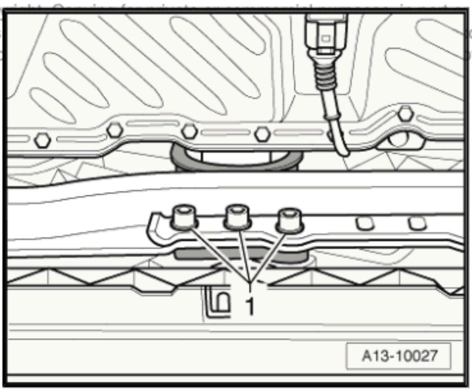


- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Fill cooling system ⇒ page 204 .

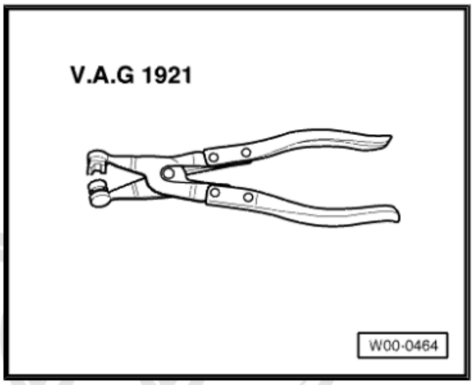
Tightening torques

Component		Nm
Top coolant pipe to oil cooler		9
Torque reaction support bracket to air pipe (bottom)		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.12 Removing and installing coolant pipe (rear)

Special tools and workshop equipment required

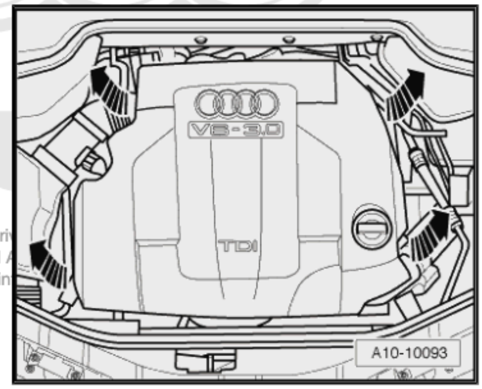
- Hose clip pliers -V.A.G 1921-



Removing

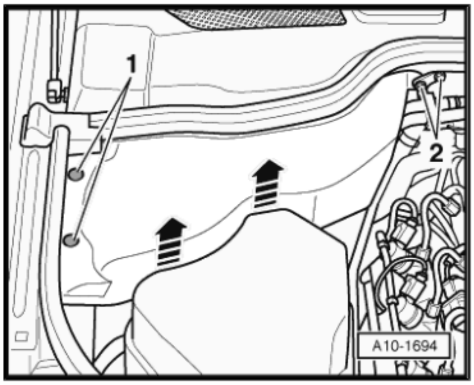
– Drain off coolant ⇒ page 202 .

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.

– Pull cover out of retainers -arrows-.

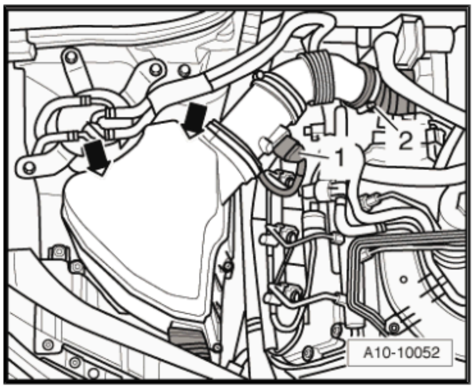


– Detach air intake hose -2- at turbocharger.

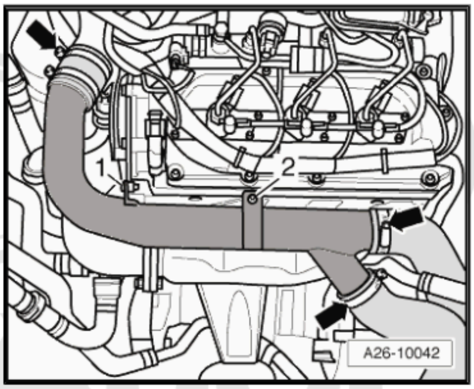
– Detach electrical connector at air mass meter -G70- .

– Remove bolts -arrows-.

– Take out air cleaner housing.



- Unscrew bolts -1- and -2- and disconnect air pipe from hoses -arrows-.



- Unbolt engine lifting eye -arrow- from cylinder head.
- Remove air pipe (right-side) from engine compartment.

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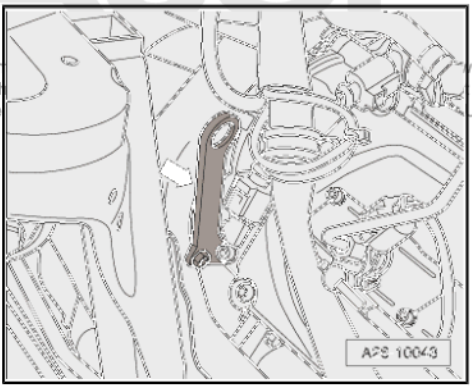
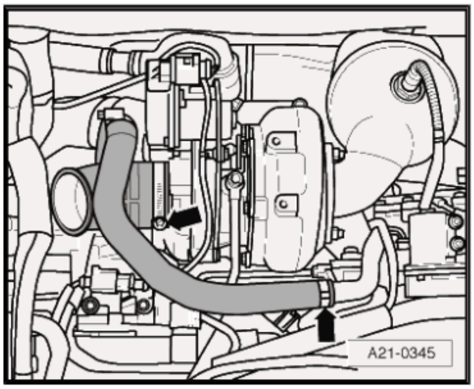
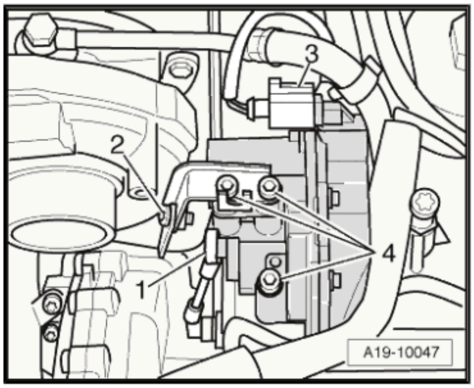


- Remove air intake hose together with crankcase breather hose -arrows-.
- Remove electrical connector for exhaust gas temperature sender 1 -G235- from bracket.

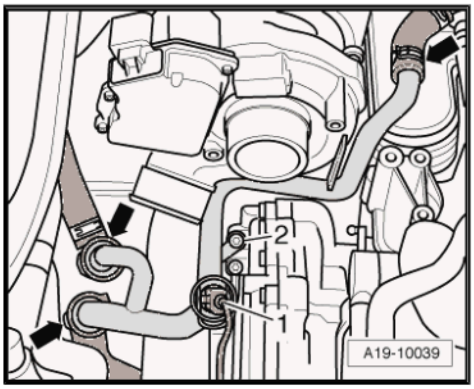


- Detach electrical connector -3- at intake manifold flap motor -V157- .
- Remove bolts -2- and -4- and move intake manifold flap motor -V157- clear to the side (with connecting rod installed).



Note

In order to prevent damage to the intake manifold flap motor -V157- , the connecting rod is not detached.



- Unplug electrical connector -1- at coolant temperature sender -G62- .
- Remove bolt -2-.
- Disconnect coolant hoses -arrows- and take out coolant pipe (rear).

Installing

Installation is carried out in the reverse order; note the following:

Note

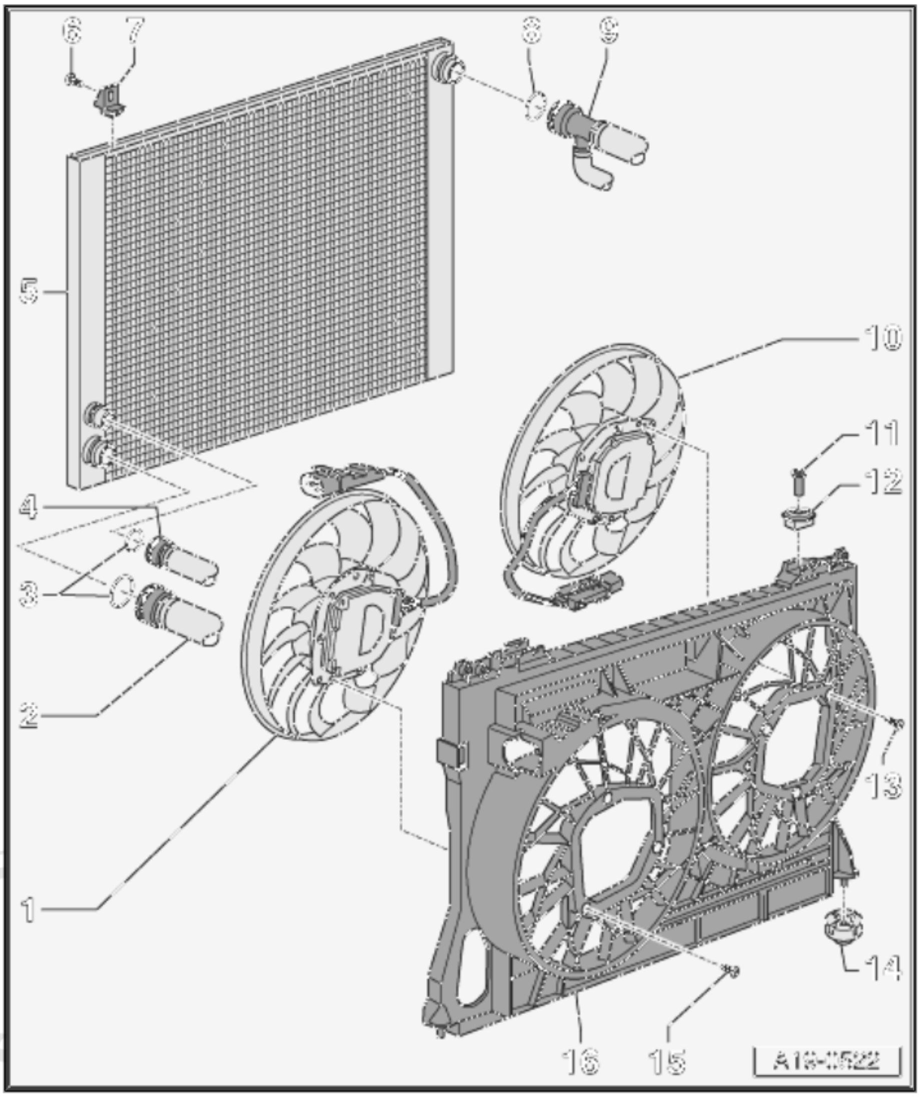
- *Renew O-ring.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Fill cooling system ⇒ page 204 .

Tightening torques

Component		Nm
Coolant pipe to cylinder head		9
Bracket to cylinder head		9
Intake manifold flap motor -V157- to intake manifold (bottom section)		9
Engine lifting eye to Cylinder head	M6	9
	M8	22
Air pipe (right-side) to:	Bracket	9
	Engine lifting eye	22
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.13 Radiator and radiator fans - exploded view



1 - Radiator fan -V7-
- ❑ With radiator fan control unit -J293-
- ❑ Removing and installing ⇒ page 238

2 - Coolant hose
- ❑ To detach, release retaining clip

3 - O-ring
- ❑ Renew

4 - Not fitted

5 - Radiator
- ❑ Removing and installing ⇒ page 232
- ❑ If renewed, change coolant in entire system

6 - 6 Nm

7 - Mounting for radiator

8 - O-ring
- ❑ Renew

9 - Coolant hose
- ❑ To detach, release retaining clip

10 - Radiator fan 2 -V177-
- ❑ With radiator fan control unit 2 -J671-
- ❑ Removing and installing ⇒ page 238

11 - Retaining pin

12 - Rubber buffer
- ❑ Use screwdriver to release and pull off

13 - 10 Nm

14 - Rubber bush

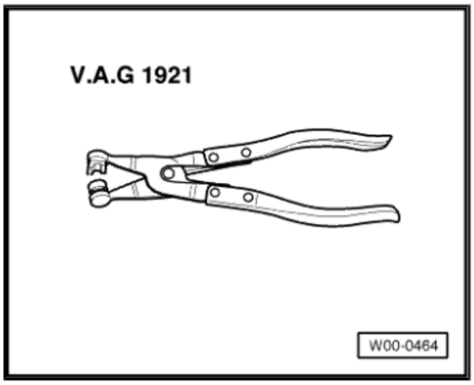
15 - 10 Nm

16 - Radiator cowl
- ❑ Removing and installing ⇒ page 237

1.14 Removing and installing radiator

Special tools and workshop equipment required

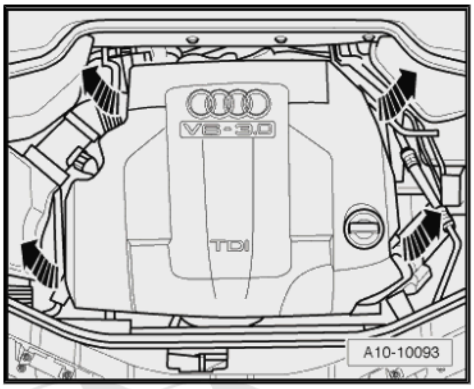
- Hose clip pliers -V.A.G 1921-



- Drip tray for workshop hoist -VAS 6208-

Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



> WARNING
>
> *Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.*

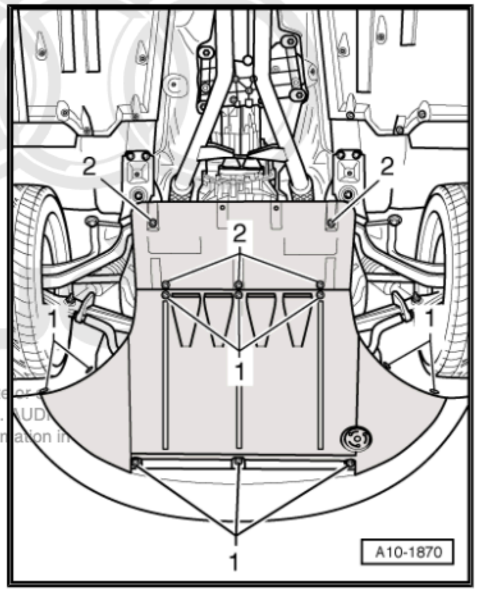
– Open filler cap on coolant expansion tank.

– Remove both front wheels.

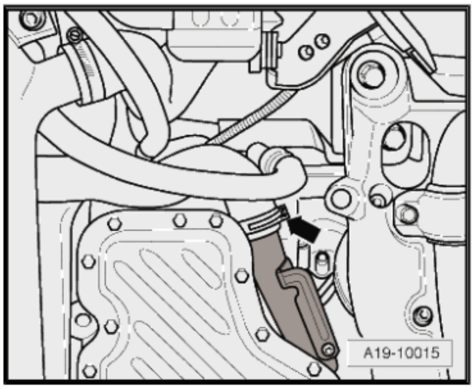
Note

Secure brake discs with wheel bolts.

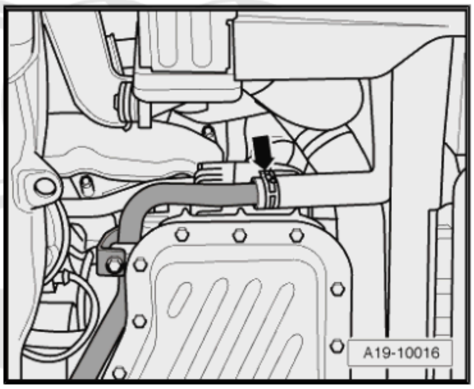
– Open quick-release fasteners -1- and remove noise insulation (front).



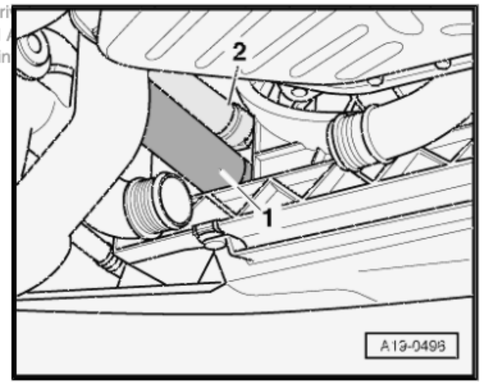
- Place drip tray for workshop hoist -VAS 6208- under engine.
- Disconnect coolant hose -arrow- from coolant pipe (left-side) and drain off coolant.



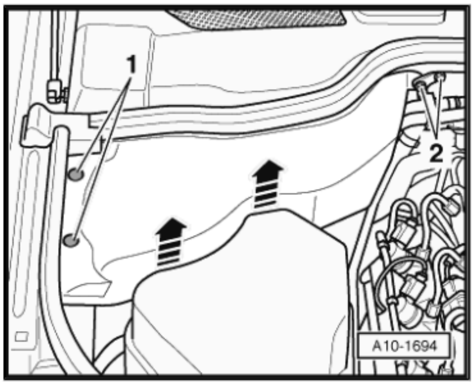
- Disconnect coolant hose -arrow- from coolant pipe (right-side) and drain off coolant.



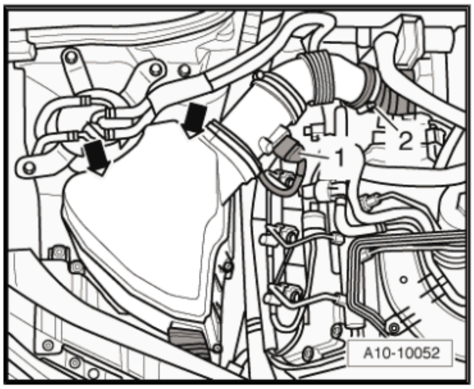
- Release retaining clips and disconnect coolant hoses -1- and -2- at radiator.
- Remove front sections of front wheel housing liners (left and right) ⇒ Rep. gr. 66 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .



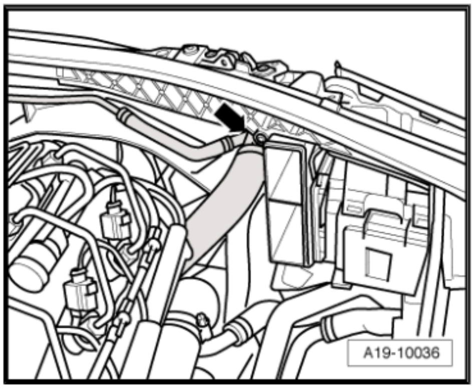
- Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- Pull cover out of retainers -arrows-.



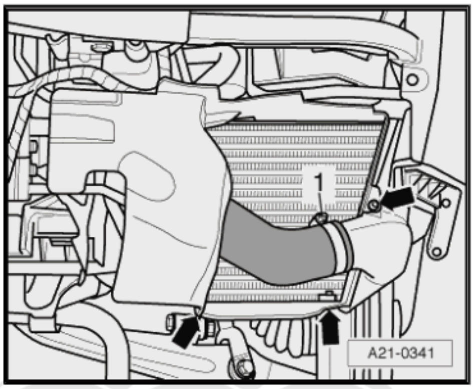
- Detach air intake hose -2- at turbocharger.
- Detach electrical connector at air mass meter -G70- .
- Remove bolts -arrows-.
- Take out air cleaner housing.



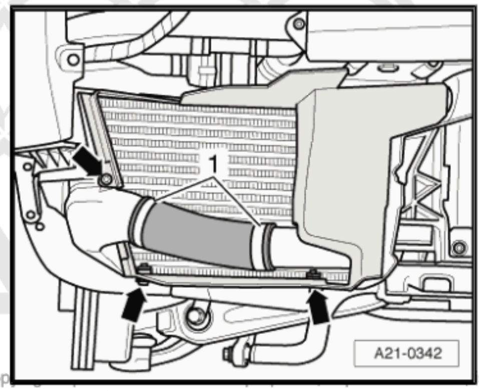
- Pull off retaining clip and disconnect top coolant hose -arrow- from radiator.



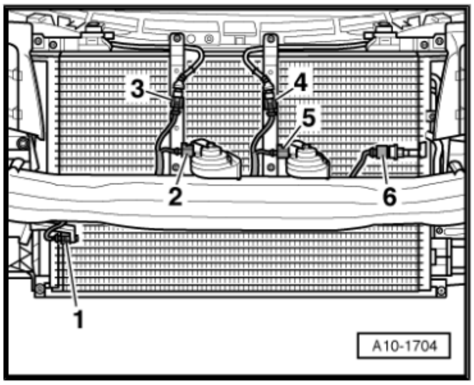
- Open hose clip -1- and disconnect air intake hose.
- Remove bolts -arrows-.
- Detach air duct from charge air cooler (left-side).



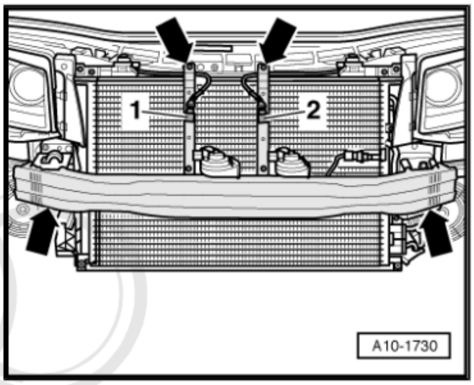
- Open hose clips -1- and disconnect air intake hose.
- Remove bolts -arrows-.
- Detach air duct from charge air cooler (right-side).



- Unplug electrical connectors -1 ... 6-.
- Move wiring clear.
- Remove bracket for ambient temperature sensor -G17- by turning bracket 90° in clockwise direction and then detaching it.



- Unplug electrical connectors -1- and -2- from struts.
- Remove bolts -arrows-.
- Remove bumper cover together with struts.
- Place drip tray for workshop hoist -VAS 6208- under engine.

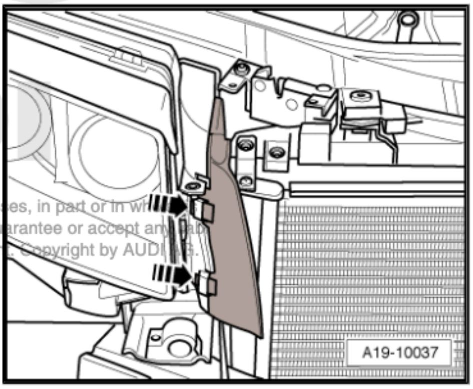


- Remove air duct (right-side) -arrows-.

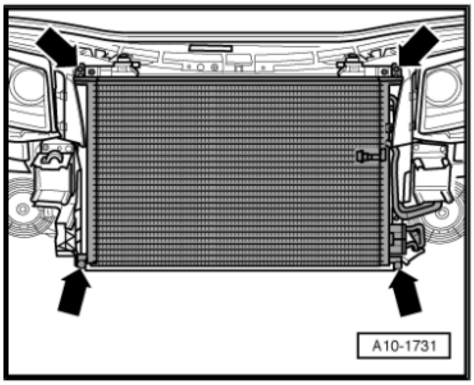
> ⚠ WARNING
>
> *The air conditioner refrigerant circuit must not be opened.*

Note

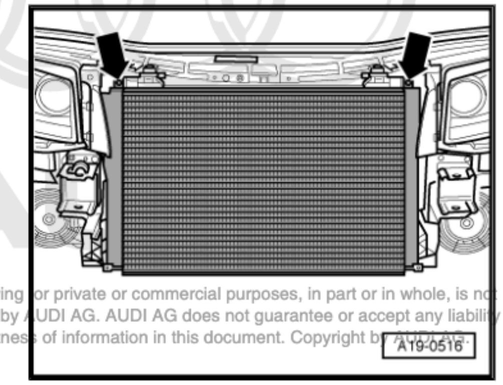
To prevent damage to the air conditioner compressor and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.



- Remove bolts -arrows-.
- Pivot condenser downwards together with cooler for power steering.
- Tie up condenser on engine.



- Remove the two brackets for radiator -arrows-.
- Tilt top of radiator forwards slightly and lift out of lock carrier.



Installing

Installation is carried out in the reverse order; note the following:

Note

- ◆ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ◆ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Fill cooling system ⇒ page 204 .

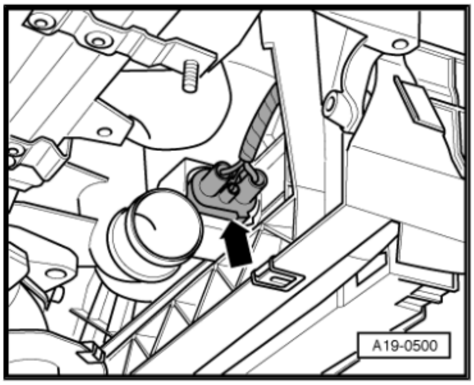
Tightening torques

Component		Nm
Bracket for radiator to lock carrier		6
Condenser to lock carrier		6
Struts to lock carrier		9
Bumper to impact damper		23
Bracket for charge air cooler to body		9
Air duct to charge air cooler		9
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

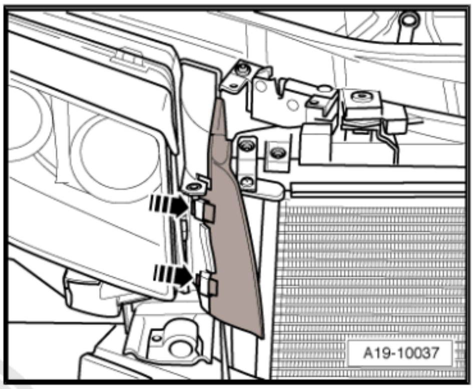
1.15 Removing and installing radiator cowl

Removing

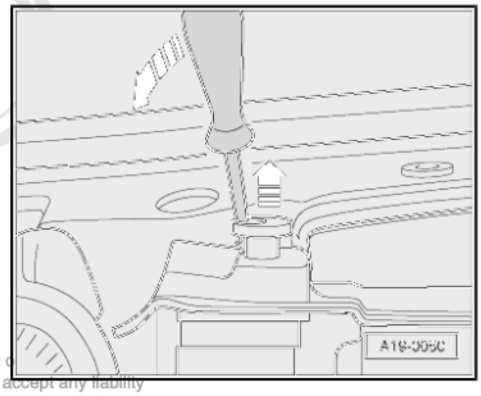
- Drain off coolant ⇒ page 202 .
- Remove radiator ⇒ page 232 .
- Unplug electrical connector -arrow- for radiator fans.
- Move wires clear at rear of lock carrier.



- Remove air duct (right-side) -arrows-.



- Release both retaining pins for radiator cowl and pull out upwards -arrows-.
- Tilt top edge of radiator cowl forwards.

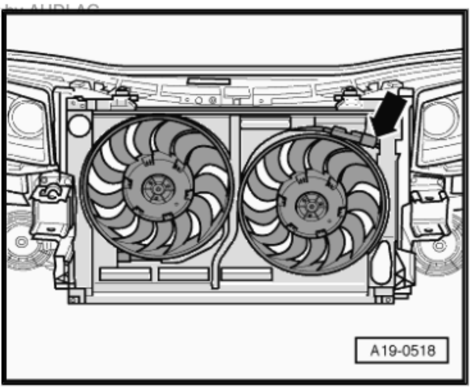


- Reach behind radiator cowl and unplug electrical connector -arrow- for radiator fans.
- Remove radiator cowl.

Installing

Installation is carried out in the reverse order; note the following:

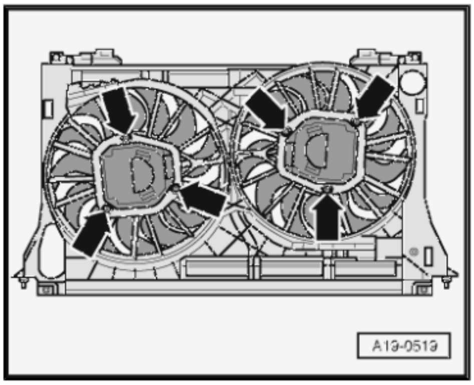
- Install radiator ⇒ page 232 .
- Fill cooling system ⇒ page 204 .



1.16 Removing and installing radiator fans

Removing

- Drain off coolant ⇒ page 202 .
- Remove radiator ⇒ page 232 .
- Remove radiator cowl ⇒ page 237 .



- Remove bolts -arrows-.
- Unclip electrical connectors and lay wiring aside.
- Remove radiator fans.

Installing

Installation is carried out in the reverse order; note the following:

- Install radiator cowl ⇒ page 237 .
- Install radiator ⇒ page 232 .
- Fill cooling system ⇒ page 204 .

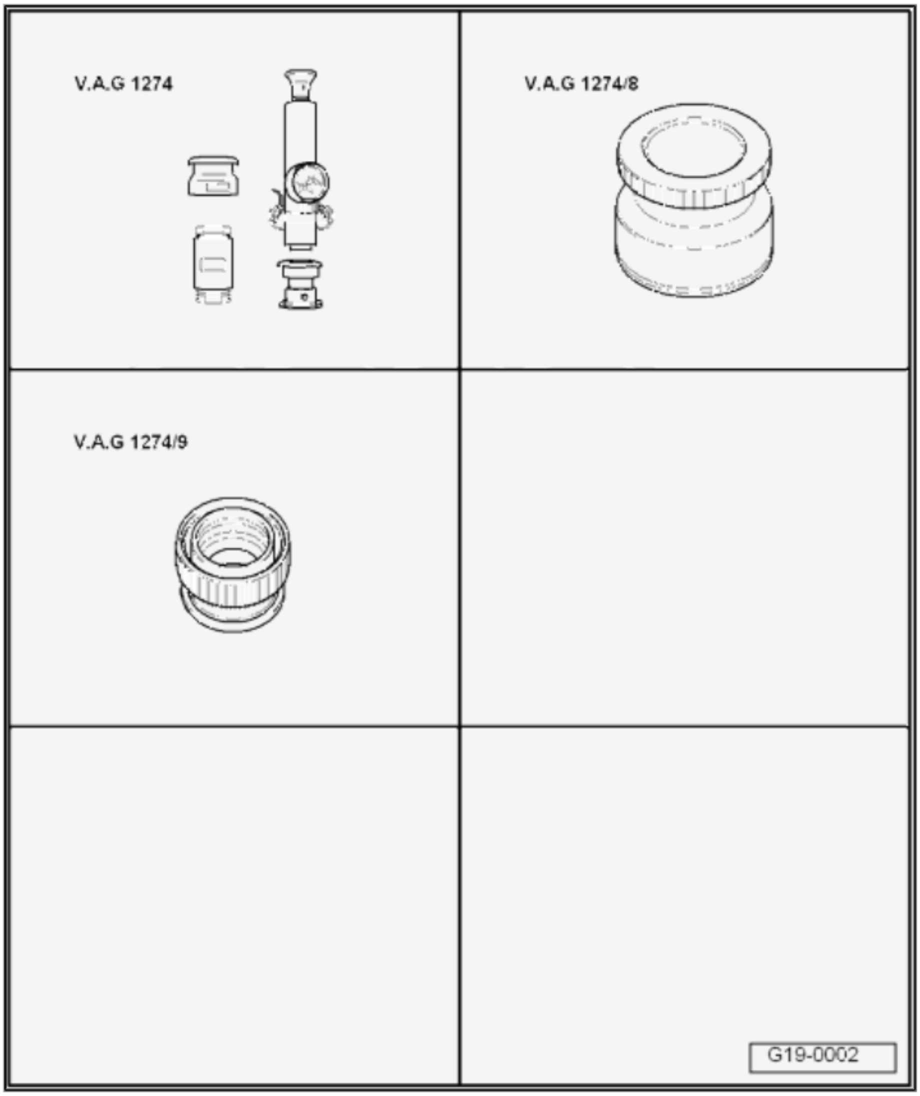
Tightening torque

Component	Nm
Radiator fan to radiator cowl	10 [1]
• [1] Renew bolt.	

1.17 Checking cooling system for leaks

Special tools and workshop equipment required

- ◆ Cooling system tester -V.A.G 1274-
- ◆ Adapter for cooling system tester -V.A.G 1274/8-
- ◆ Adapter for cooling system tester -V.A.G 1274/9-

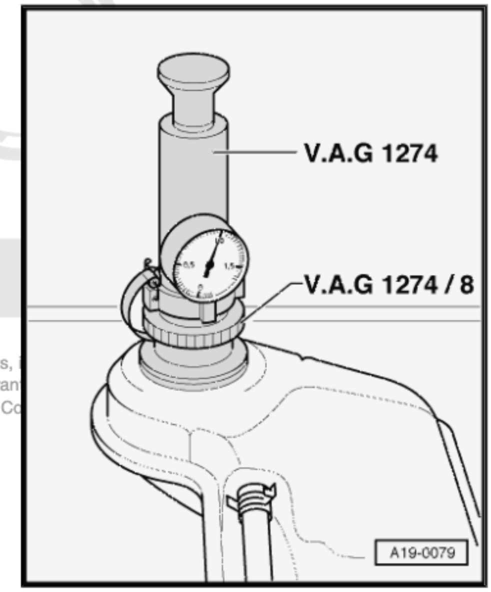


Procedure

- Engine must be warm.

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.



– Open filler cap on coolant expansion tank.

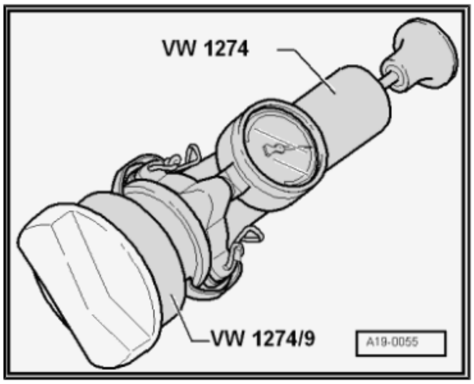
– Attach cooling system tester -V.A.G 1274- with adapter -V.A.G 1274/8- to coolant expansion tank.

– Use hand pump on cooling system tester to create a pressure of approx. 1.0 bar.

If the pressure drops:

– Trace leak and repair.

Checking pressure relief valve in filler cap



– Attach cooling system tester -V.A.G 1274- with adapter -V.A.G 1274/9- to filler cap.

– Use hand pump on cooling system tester to create pressure.

- The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.

If the pressure relief valve does not open as described:

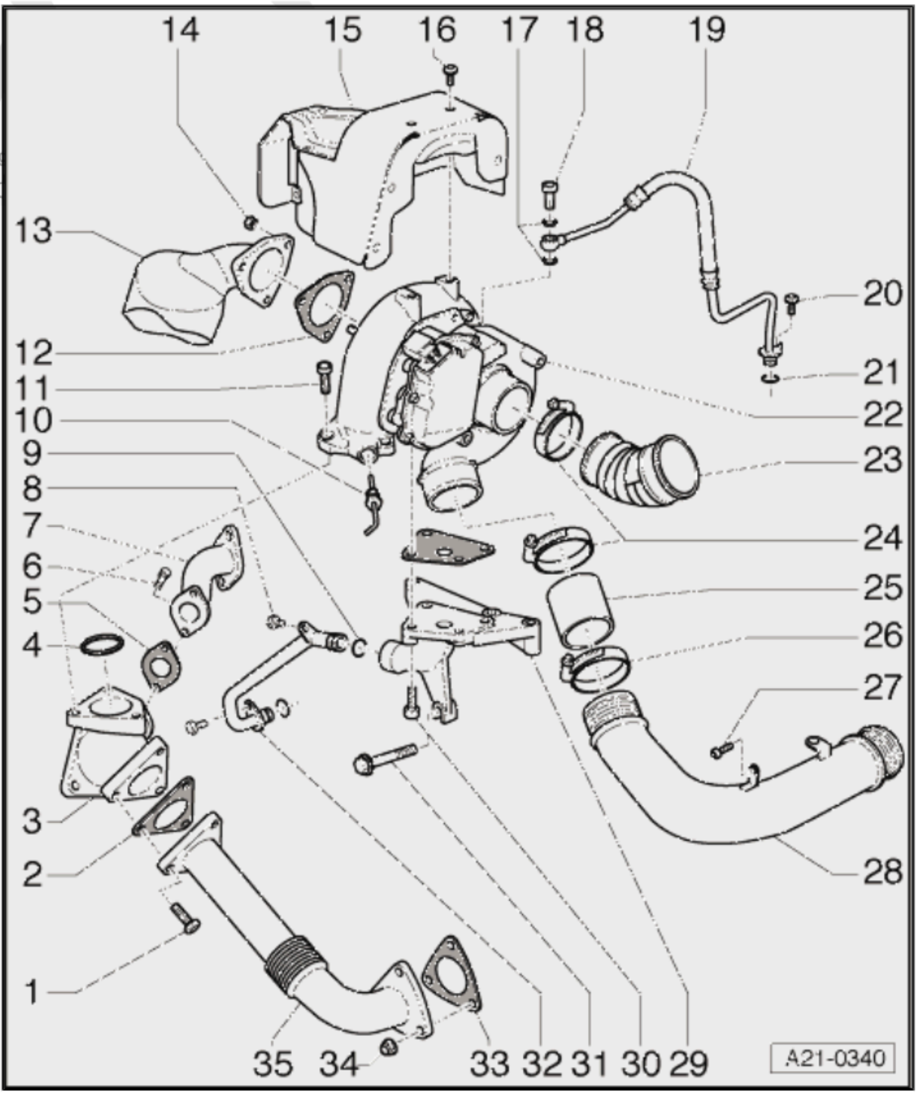
– Renew filler cap.

21 – Turbocharging/supercharging

1 Servicing charge air system with turbocharger

– Observe rules for cleanliness ⇒ page 6 .

1.1 Turbocharger - exploded view



1 - 30 Nm + 90° ($^1/_4$ turn) further

- ☐ Renew
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

2 - Gasket

- ☐ Renew

3 - Intermediate flange

- ☐ Removing and installing ⇒ page 254

4 - Seal

- ☐ Renew

5 - Gasket

- ☐ Renew

6 - 9 Nm

- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

7 - Connecting pipe to change-over flap for exhaust gas recirculation cooler

8 - 9 Nm

9 - O-ring

- ☐ Renew

10 - Exhaust gas temperature sender 1 -G235-

- ☐ Removing and installing ⇒ page 295
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

11 - 30 Nm + 90° ($^1/_4$ turn) further

- ☐ Renew
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

12 - Gasket

- ☐ Renew

13 - Starter catalytic converter

- ☐ Removing and installing ⇒ page 263

14 - 27 Nm

☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

15 - Heat shield for turbocharger

16 - 9 Nm

17 - Seals

☐ Renew

18 - Banjo bolt, 15 Nm

19 - Oil supply line

☐ From cylinder block

20 - 9 Nm

21 - O-ring

☐ Renew

22 - Turbocharger

☐ Removing and installing ⇒ page 243

☐ Removing and installing turbocharger 1 control unit -J724- ⇒ page 245

23 - Air hose

☐ From air mass meter -G70- to turbocharger

☐ Must be free of oil and grease when installing

24 - Retaining clip, 5.5 Nm

☐ Reinforced

25 - Air hose

☐ Must be free of oil and grease when installing

26 - Retaining clip, 5.5 Nm

☐ Reinforced

27 - 9 Nm

28 - Air pipe (right-side)

29 - Bracket for turbocharger

30 - 20 Nm

☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

31 - 25 Nm

32 - Oil return line

☐ To cylinder block

33 - Gasket

☐ Renew

34 - 30 Nm + 90° ($^{1}/_{4}$ turn) further

☐ Type of connection differs depending on version ⇒ page 243

35 - Intermediate pipe

☐ Removing and installing: left-side ⇒ page 292 , right-side ⇒ page 294

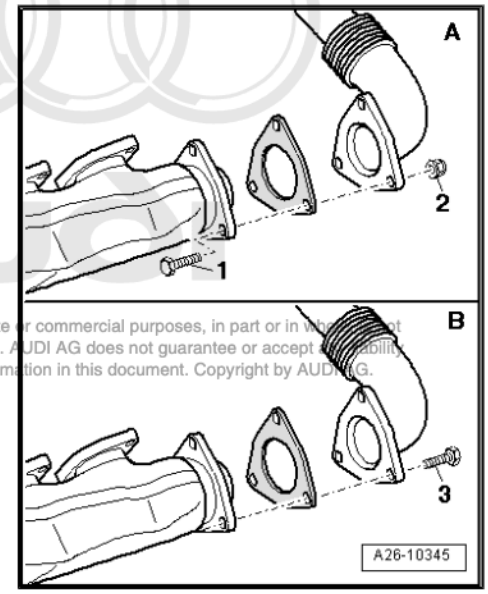
Securing intermediate pipe to exhaust manifold

A - Exhaust manifold (sheet metal version)

- Fitted with bolts -1- and nuts -2-.
- Renew bolts and nuts.
- Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

B - Exhaust manifold (cast version)

- Fitted with bolts -3-.
- Renew bolts.
- Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue



1.2 Removing and installing turbocharger

Removing

Caution

If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- *Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.*
- *Check the entire charge air system (including the charge air cooler) for foreign matter.*
- *If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.*

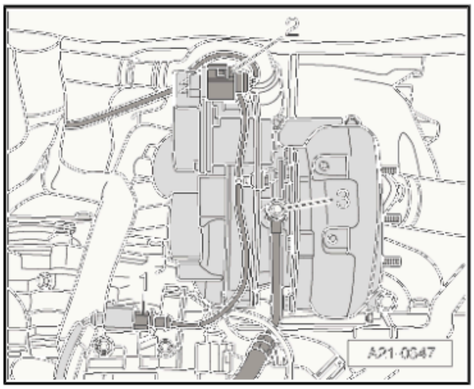
– Drain off coolant ⇒ page 202 .

– Remove starter catalytic converter ⇒ page 263 .

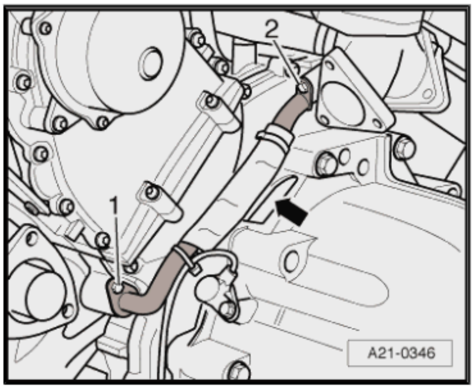
– Unplug electrical connectors -1- and -2-.

– Remove banjo bolt -3- and disconnect oil supply line from turbocharger.

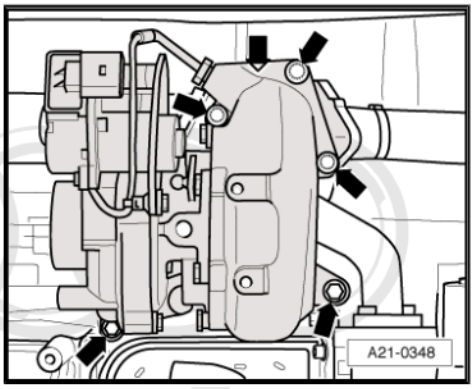
– Remove coolant pipe (rear) ⇒ page 228 .



- Cover opening -arrow- in gearbox to prevent small parts from dropping in.
- Unscrew bolts -1- and -2- and detach oil return line.



- Unscrew bolts -arrows- and detach turbocharger from intermediate flange.



Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets and seals.*
- *Fill turbocharger with engine oil at connection for oil supply line.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *After installing turbocharger, allow engine to idle for approx. 1 minute and do not rev up immediately to ensure turbocharger is supplied with oil.*

- Install starter catalytic converter ⇒ page 263 .
- Install coolant pipe (rear) ⇒ page 228 .
- Fill cooling system ⇒ page 204 .

Tightening torques

Component		Nm
Turbocharger to:	Intermediate flange	30 + 90 ° 1)2)3)
	Engine	25
Oil return pipe to:	Turbocharger	9
	Cylinder block	9
Oil supply line to turbocharger		15

- 1) Renew bolts.
- 2) 90° = one quarter turn.
- 3) Coat with high-temperature paste; refer to ⇒ Parts catalogue .

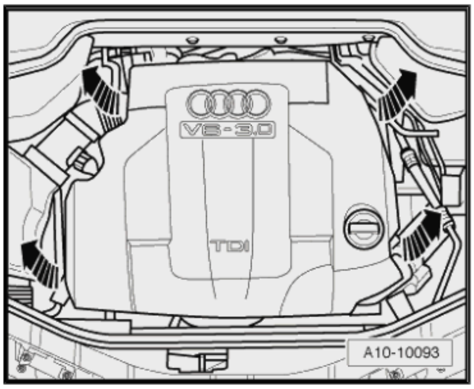
1.3 Removing and installing turbocharger control unit 1 -J724-

Special tools and workshop equipment required

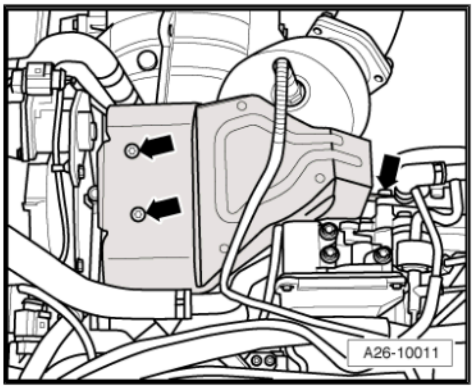
- Tester for E-positioner -VAS 6395-
- Connection lead -VAS 6395/4-2-
- Open-end spanner, 10 mm (90 mm long) -VAS 6395/4-3-

Removing

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Remove bolts -arrows- and detach heat shield for turbocharger.



Note

The bottom bolt -right arrow- does not have to be completely removed.

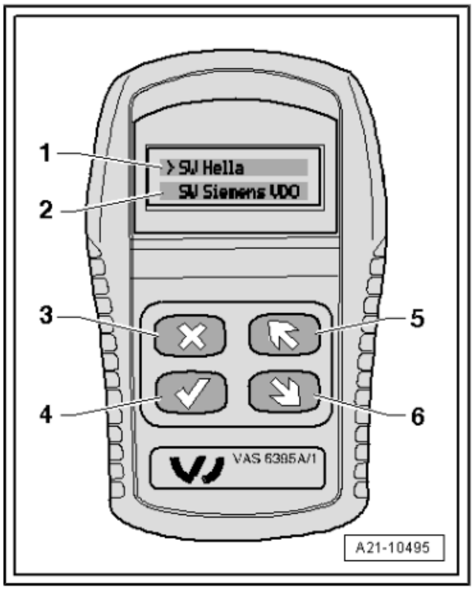
– Connect tester for E-positioner -VAS 6395- to positive terminal „+“ and negative terminal „–“ with connection lead -VAS 6395/4-2- .

Note

On vehicles without positive/negative terminal in engine compartment, connect tester for E-positioner to external current supply (12 V battery) with connection lead .

Procedure for tester for E-positioner -VAS 6395A/1- :

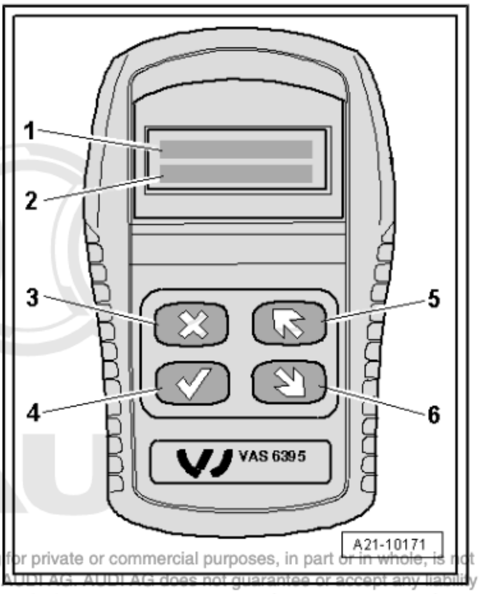
- Select software version with buttons ↑ -item 5- and ↓ -item 6-.
- To confirm software version, press v button -item 4-.



Note

In this example, software version Hella -item 1- is selected.

Procedure for tester for E-positioner -VAS 6395/1- :



Caution

Risk of damage to turbocharger 1 control unit -J724- .

- *Before continuing, check whether the correct software version is loaded in the tester for E-positioner -VAS 6395/1- . To do so, proceed as follows:*

Display on -VAS 6395/1- (2 seconds after connecting to power supply) if correct software version is loaded:

1 - >TEST

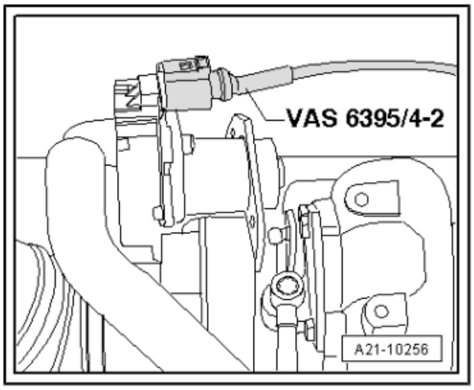
2 - LEARN

Note

- *If the following appears on the display, an incorrect software version has been loaded:*
- *1. START*
- *2. NEXT*
- *If this is the case, download the correct software version from the „Audi ServiceNet“ under „Workshop Equipment“.*

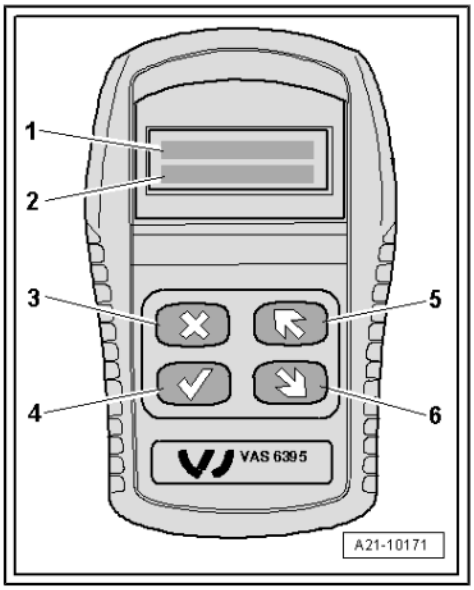
Continued for both testers for E-positioner :

- Unplug electrical connector for turbocharger 1 control unit -J724- .
- Connect connection lead -VAS 6395/4-2- to turbocharger 1 control unit -J724- and to tester for E-positioner -VAS 6395- .



Display on -VAS 6395- :

– To continue, press ☑ button -item 4-.

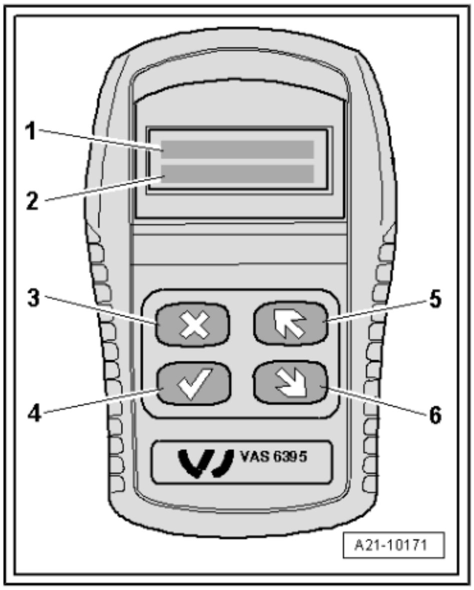


Display on -VAS 6395- :

1 - CHECK

2 - S: XX % I: XX %

- The tester for E-positioner -VAS 6395- runs through the adjustment range of the turbocharger 1 control unit -J724- and checks the feedback of the positions.



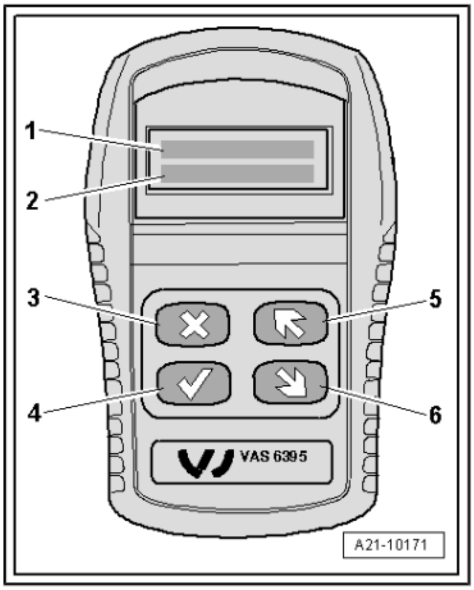
Display on -VAS 6395- if turbocharger 1 control unit -J724- is OK:

1 - ACTUATOR OK

- The test is completed.

– Unplug electrical connectors for tester for E-positioner -VAS 6395- .

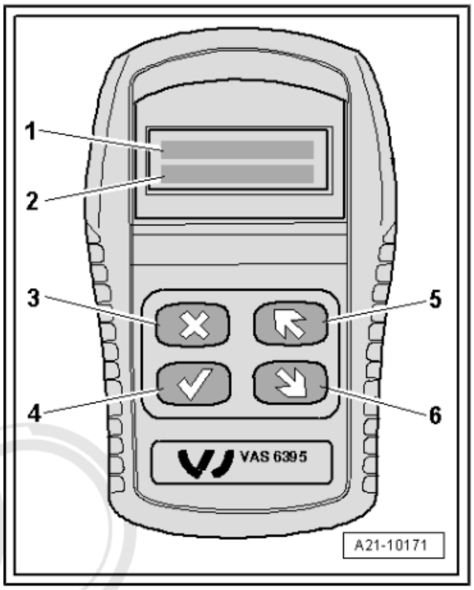
Assemble in reverse order.



Display on -VAS 6395- if turbocharger 1 control unit -J724- is not OK:

1 - PROBLEM

- Renew turbocharger 1 control unit -J724- .



– To do so, proceed as follows:

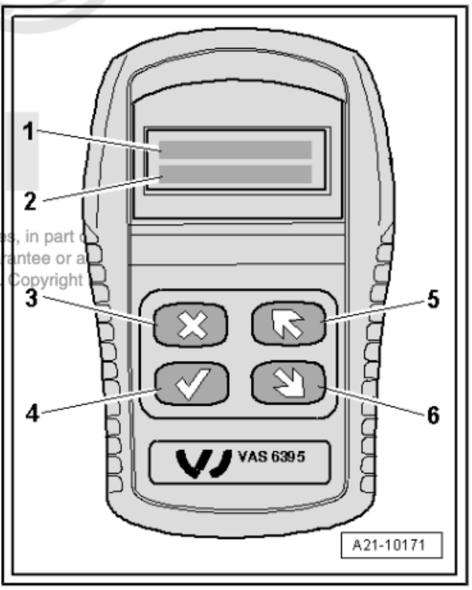
– To continue, press ⍌ button -item 4-.

Display on -VAS 6395/1- :

1 - >TEST

2 - LEARN

– Press ⍗ button -item 6-.

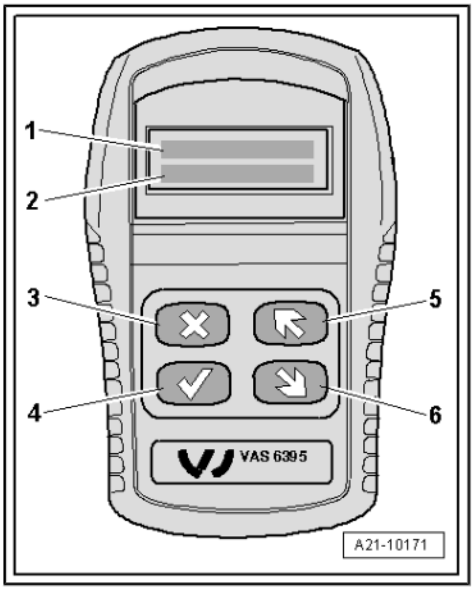


Display on -VAS 6395- :

1 - TEST

2 - >LEARN

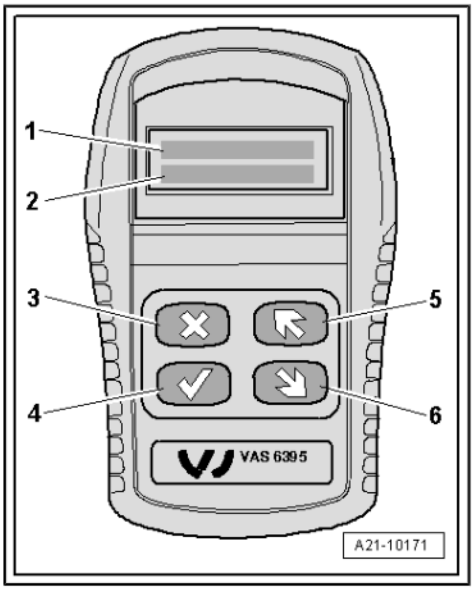
– To continue, press ⍌ button -item 4-.



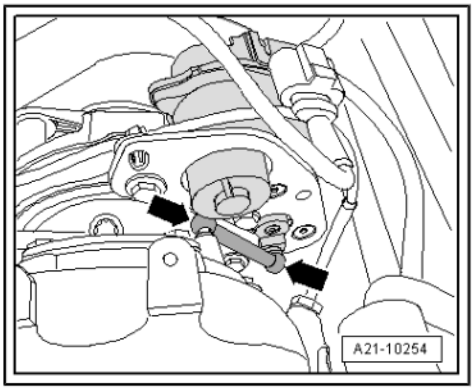
Display on -VAS 6395- :

1 - STEP 1

– By pressing buttons ↑ -item 5- and ↓ -item 6-, adjust turbocharger 1 control unit -J724- so that coupling rod can be accessed easily for removal.



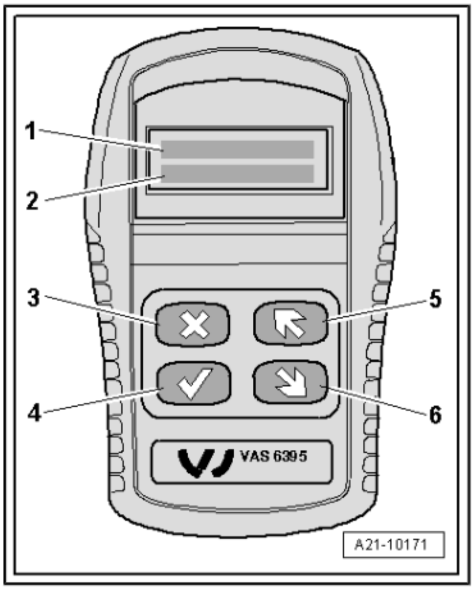
– Unclip coupling rod -arrows- and dispose of it.



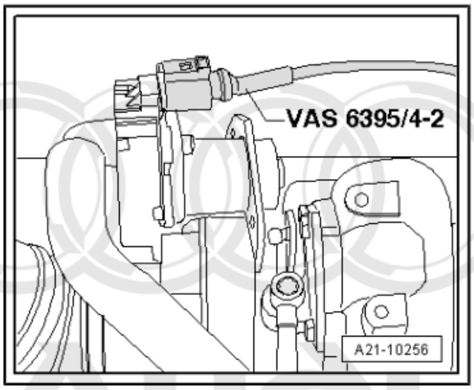
– To continue, press ✓ button -item 4-.

Display on -VAS 6395- :

1 - STEP 2

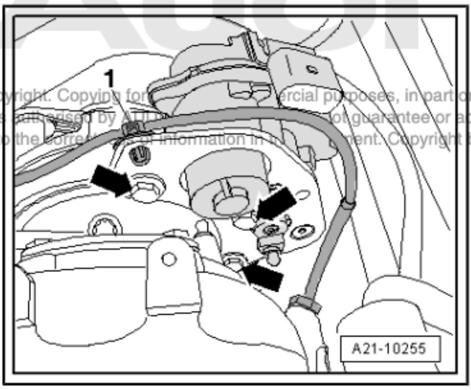


- Disconnect connection lead -VAS 6395/4-2- from turbocharger 1 control unit -J724- .

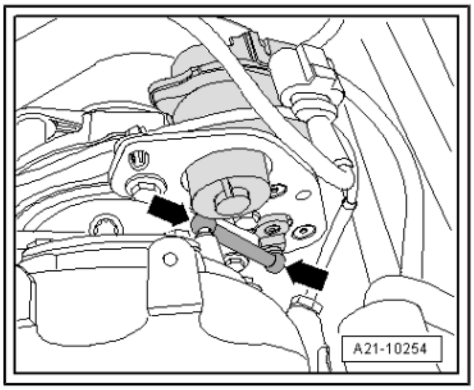


> **Caution**
>
> *Tester for E-positioner -VAS 6395- should remain connected to power supply.*

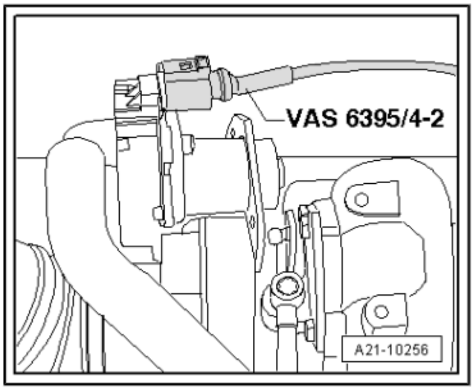
- Unclip retaining clip -1- for electrical wire.
- Remove bolts -arrows-; use open-end spanner, 10 mm (90 mm long) -VAS 6395/4-3- for bolts at centre and bottom.
- Remove old turbocharger 1 control unit -J724- and dispose of it.
- Install new turbocharger 1 control unit -J724- in reverse order of removal, tighten bolts -arrows- only hand-tight.
- Turbocharger 1 control unit -J724- must rest on retaining plate so there is no play; it must still be possible to move control unit by hand.



- Clip on new coupling rod -arrows-.



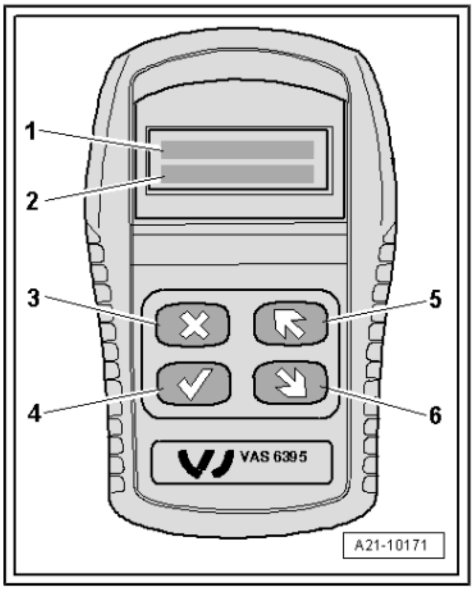
- Connect connection lead -VAS 6395/4-2- to turbocharger 1 control unit -J724- .



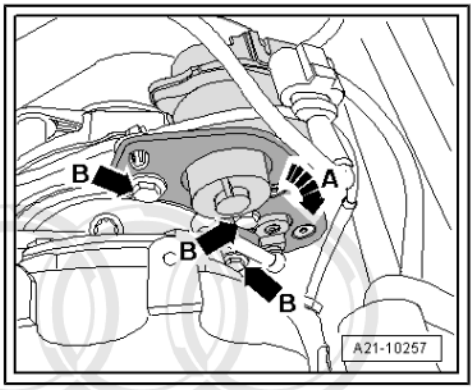
– To continue, press v button -item 4-.

Display on -VAS 6395- :

1 - STEP 3



– Press turbocharger 1 control unit -J724- downwards and towards rear using moderate pressure -arrow A-, at the same time tighten bolts -arrows B- to 10 Nm using open-end spanner, 10 mm (90 mm long) -VAS 6395/4-3- for centre and bottom bolts.



– To continue, press v button -item 4-.

Display on -VAS 6395- :

1 - WARNING

2 - LEARNING

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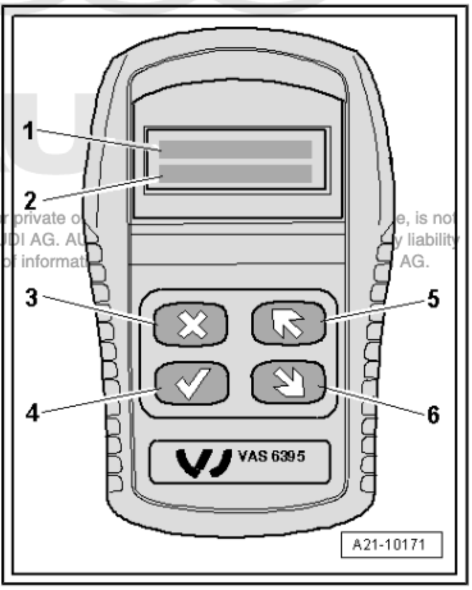
permitted unless authorised by AUDI AG. AU… y liability
with respect to the correctness of informat… AG.

Caution

- *Now check correct installation of turbocharger 1 control unit -J724- ; from the next step of the programme onwards (confirmed by the v button -item 4-) the turbocharger 1 control unit -J724- learns the limit positions of the adjustment travel once only. If the limit positions are not stored correctly due to an incorrect installation position, the learning procedure of turbocharger 1 control unit -J724- cannot be repeated and the control unit must be renewed.*
- *If you are not certain that the installation position is correct, you can terminate the procedure by pressing the x button -item 3- and the start the procedure again.*



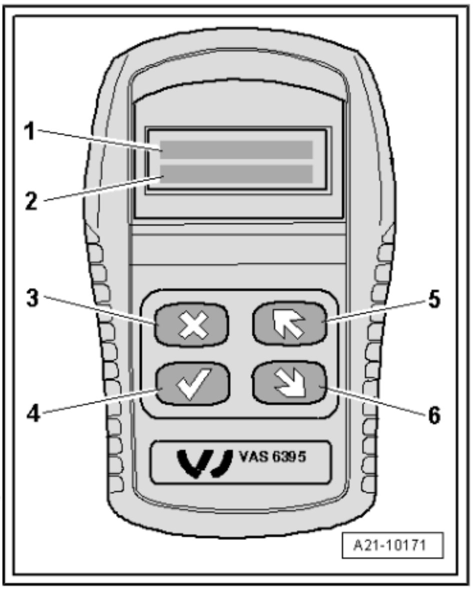
– To confirm that the new turbocharger 1 control unit -J724- has been correctly installed, press ☑ button -item 4-.

Display on -VAS 6395- :

1 - TEST 1

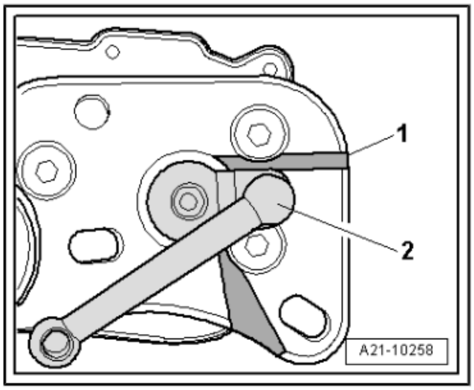
2 - S: 80.0 % I: XX %

- Specification: I = 80 %, successful learning is confirmed by the display „LEARNING“ in display zone -1-.



– At the same time, check position of adjustment lever at turbocharger 1 control unit -J724- :

- The edge of adjustment lever -2- must be within marking -1-.



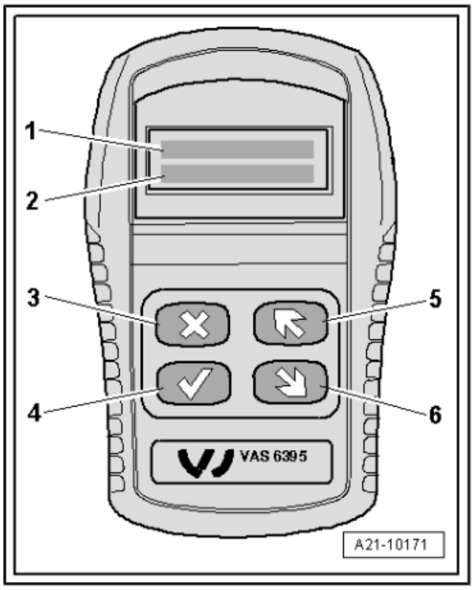
– To continue, press ☑ button -item 4-.

Display on -VAS 6395- :

1 - TEST 2

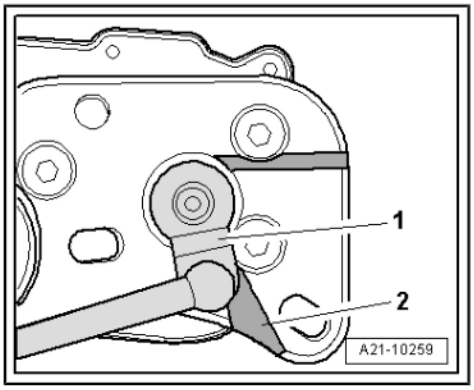
2 - S: 16.0 % I: XX %

- Specification: I = 16 %, successful learning is confirmed by the display „LEARNING“ in display zone -1-.



– At the same time, check position of adjustment lever at turbocharger 1 control unit -J724- :

- The edge of adjustment lever -1- must be within marking -2-.



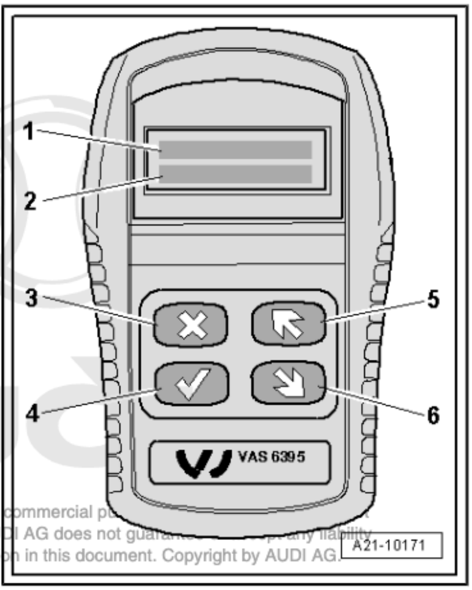
– To continue, press ☑ button -item 4-.

Display on -VAS 6395- :

1 - TEST 3

2 - S: 55.0 % I: XX %

- Check of centre position is now performed.



– To continue, press ☑ button -item 4-.

Display on -VAS 6395- :

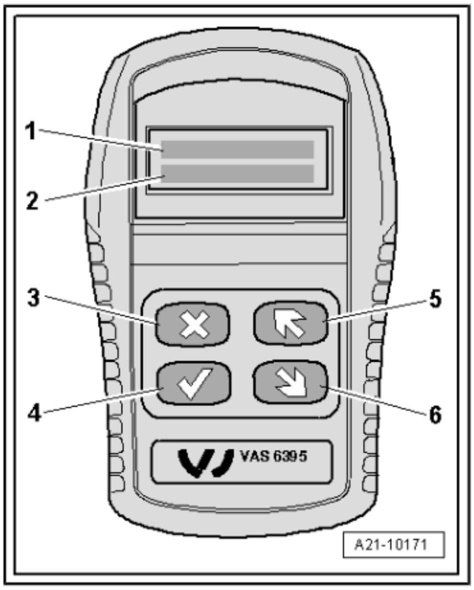
1 - OK

– To confirm, press ☑ button -item 4-.

- Adjustment is completed.

– Unplug electrical connectors for tester for E-positioner -VAS 6395- .

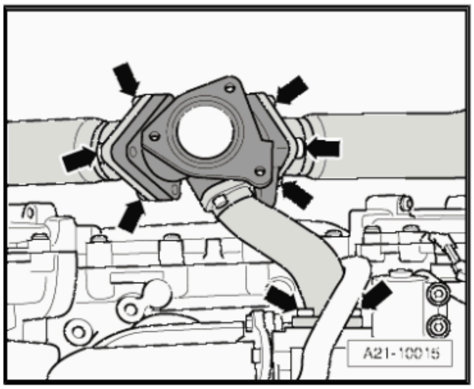
Assemble in reverse order.



1.4 Removing and installing intermediate flange

Removing

- Remove turbocharger ⇒ page 243 .
- Unscrew bolts -arrows- and detach intermediate flange with connecting pipe for exhaust gas recirculation.



Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seals and gaskets.

- Install turbocharger ⇒ page 243 .

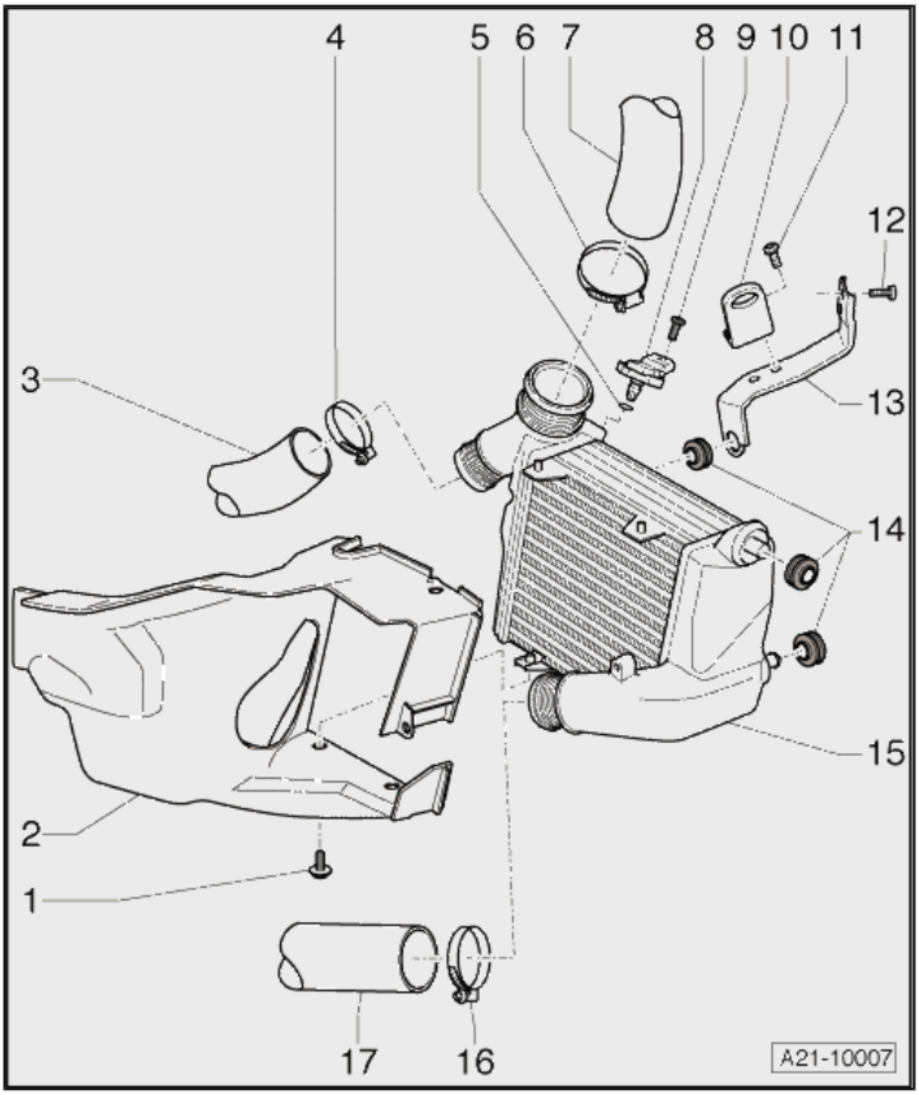
Tightening torques

Component		Nm
EGR connecting pipe to:	Intermediate flange	9 1)
	Change-over flap for exhaust gas recirculation cooler	25
Intermediate pipe to intermediate flange		30 + 90° 1)2)3)
• 1) Coat with high-temperature paste; refer to ⇒ Parts catalogue . • 2) Renew bolts. • 3) 90° = one quarter turn.		

1.5 Charge air cooling - exploded view

Note

Illustration shows left-side charge air cooler.



1 - 5 Nm

2 - Front air duct

3 - Air hose

- ❑ Between top air pipe and charge air cooler
- ❑ Must be free of oil and grease when installing

4 - Retaining clip, 5.5 Nm

- ❑ Reinforced

5 - O-ring

- ❑ Renew

6 - Retaining clip, 5.5 Nm

- ❑ Reinforced

7 - Air hose

- ❑ Between charge air cooler and throttle valve module -J338-
- ❑ Must be free of oil and grease when installing

8 - Charge pressure sender -G31-

- ❑ Removing and installing ⇒ page 257

9 - 9 Nm

10 - Bracket

11 - 9 Nm

12 - 9 Nm

13 - Bracket

14 - Rubber grommets

15 - Charge air cooler

- ❑ Removing and installing ⇒ page 256

16 - Retaining clip, 5.5 Nm

- ❑ Reinforced

17 - Air hose

- ❑ Between charge air cooler and bottom air pipe
- ❑ Must be free of oil and grease when installing

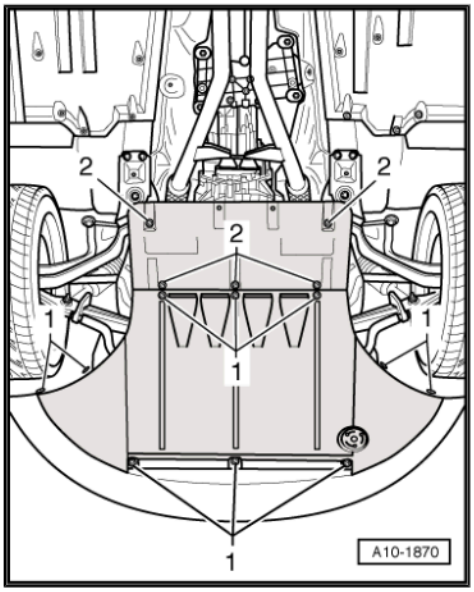
1.6 Removing and installing charge air cooler (left-side)

Removing

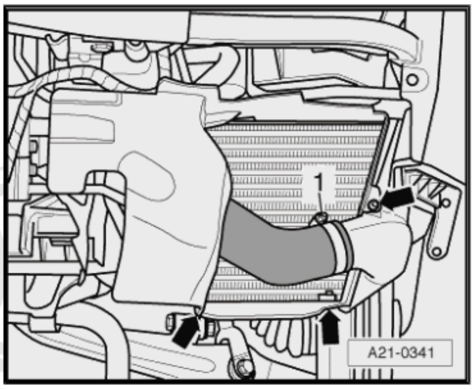
- Remove both front wheels.

Note

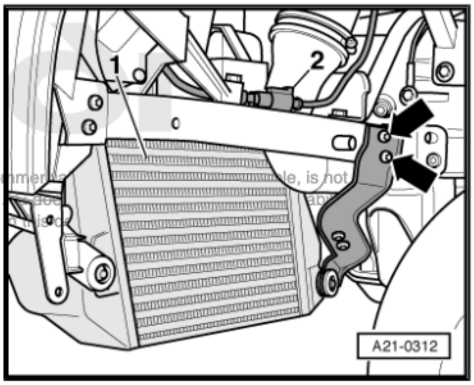
Secure brake discs with wheel bolts.



- Open quick-release fasteners -1- and remove noise insulation (front).
- Remove front section of front left wheel housing liner ⇒ Rep. gr. 66 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .



- Open hose clip -1- and disconnect air intake hose.
- Remove bolts -arrows-.
- Detach air duct from charge air cooler (left-side).

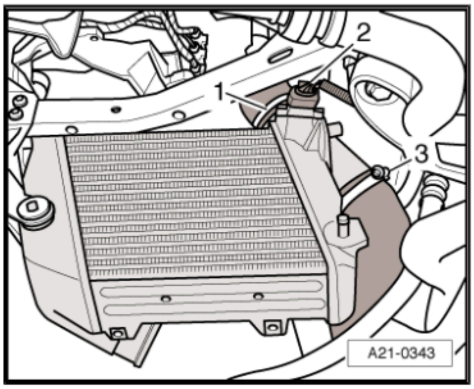


- Remove bolts -arrows- and detach bracket -1- for charge air cooler.

Note

Disregard -item 2-.

- Unplug electrical connector -2- going to charge pressure sender -G31- .
- Disconnect air intake hose -1-.
- Take off charge air cooler (left-side).



Note

Disregard -item 3-.

Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew O-rings.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

- Install bumper cover (front) ⇒ Rep. gr. 63 .

Tightening torques

Component	Nm
Bracket for charge air cooler to body	9
Air duct to charge air cooler	5
Hose clips (13 mm wide)	5.5

1.7 Removing and installing charge pressure sender -G31-

Removing

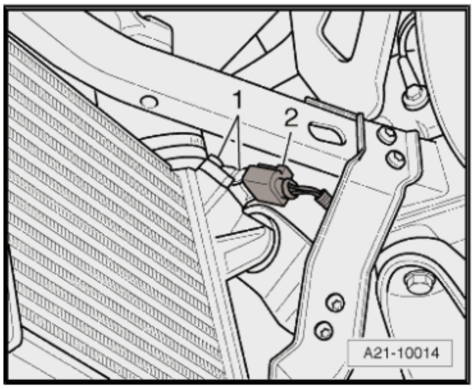
- Remove front left wheel.

Note

Secure brake disc with wheel bolts.

- Remove front section of front left wheel housing liner ⇒ Rep. gr. 66 .

- Unplug electrical connector -2-.
- Remove bolts -1- and pull charge pressure sender -G31- out of charge air cooler.



Installing

Installation is carried out in the reverse order; note the following:

Note

Renew O-ring.

Tightening torque

Component	Nm
Charge pressure sender -G31- to charge air cooler	10

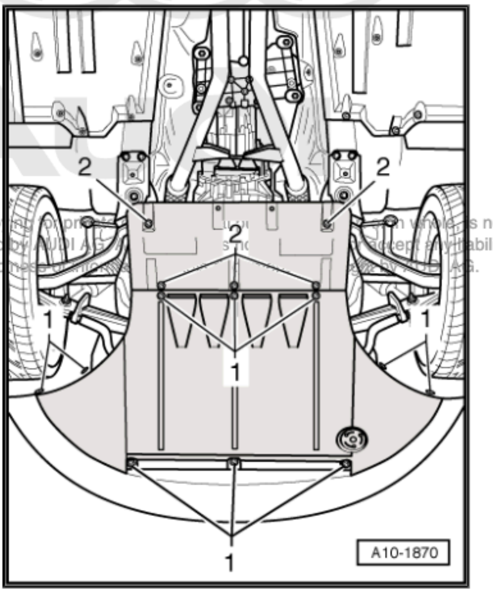
1.8 Removing and installing charge air cooler (right-side)

Removing

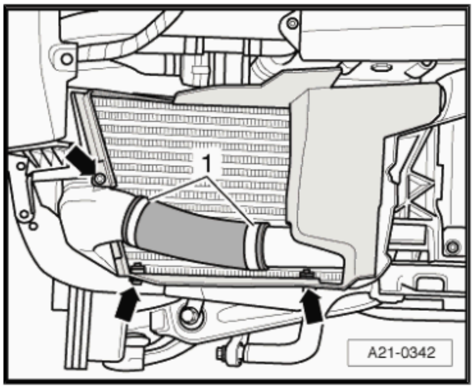
- Remove both front wheels.

Note

Secure brake discs with wheel bolts.

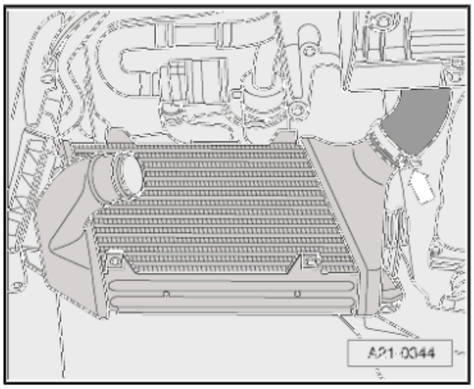


- Open quick-release fasteners -1- and remove noise insulation (front).
- Remove front section of front left wheel housing liner ⇒ Rep. gr. 66 .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .



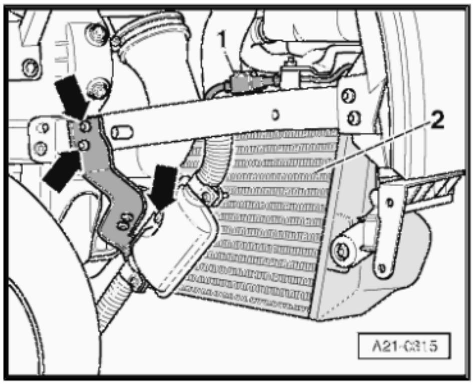
- Open hose clips -1- and disconnect air intake hose.
- Remove bolts -arrows-.
- Detach air duct from charge air cooler (right-side).

– Disconnect air hose -arrow- at front of charge air cooler (right-side).



– Remove bolts -arrows- and detach bracket for charge air cooler.

– Take off charge air cooler -2- (right-side).



Note

Disregard -item 1-.

Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew O-rings.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

– Install bumper cover (front) ⇒ Rep. gr. 63 .

Tightening torques

Component	Nm
Bracket for charge air cooler to body	9
Air duct to charge air cooler	5
Hose clips (13 mm wide)	5.5

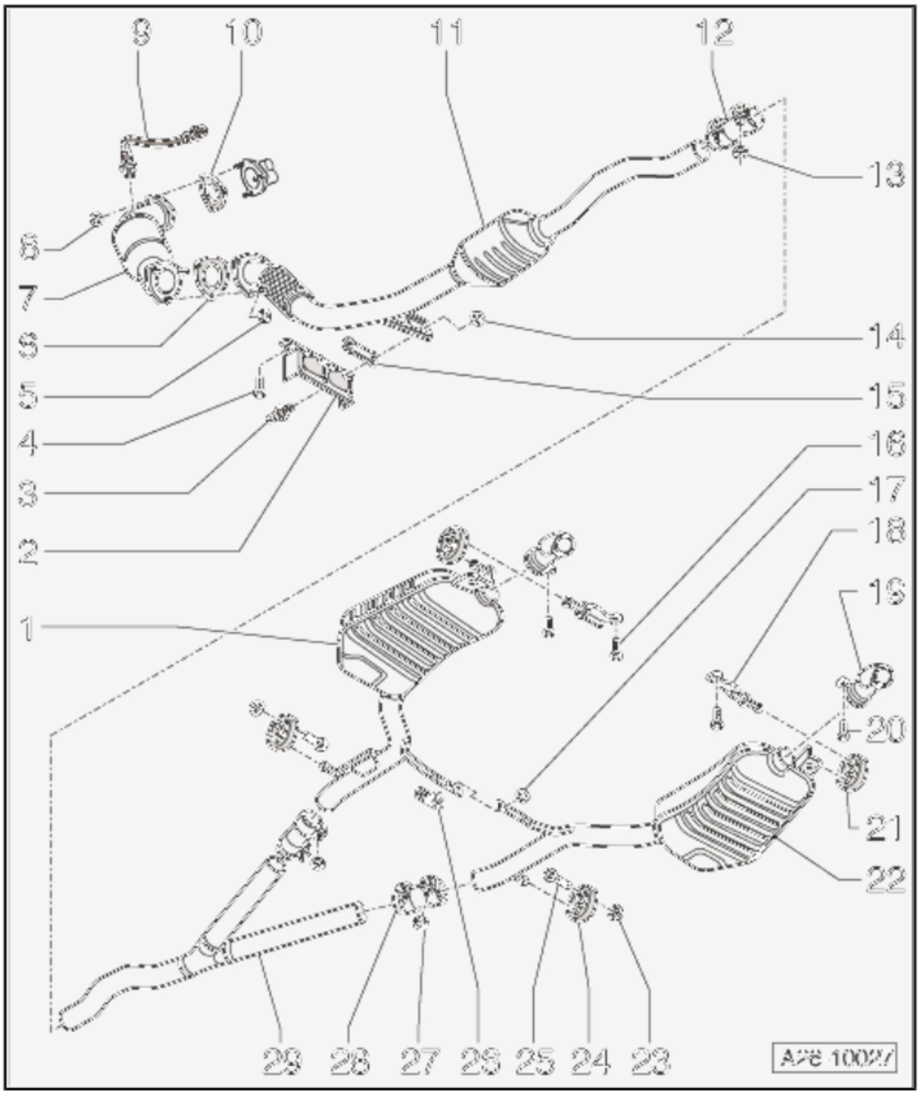
26 – Exhaust system

1 Removing and installing parts of exhaust system - vehicles without particulate filter

Note

- *Renew gaskets and self-locking nuts.*
- *After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamps and align silencers and exhaust pipes so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.*

1.1 Exhaust system - exploded view



1 - Rear silencer
- ☐ For left side of vehicle
- ☐ Combined with Y-pipe in one unit as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ page 281
- ☐ Align the exhaust system so it is free of stress ⇒ page 282 .

2 - Centre bracket for front exhaust pipe
- ☐ Mounting components ⇒ page 263

3 - Stud

4 - 25 Nm

5 - 27 Nm
- ☐ Renew
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

6 - Gasket
- ☐ Renew

7 - Starter catalytic converter
- ☐ Removing and installing ⇒ page 263
- ☐ Protect against knocks and impact
- ☐ Align the exhaust system so it is free of stress ⇒ page 282 .

8 - 27 Nm

- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

9 - Lambda probe -G39-

- ☐ The threads on the new Lambda probes are coated with a special assembly paste.
- ☐ If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Parts catalogue for high-temperature paste.
- ☐ The assembly paste/high-temperature paste must not get into the slots on the probe body.
- ☐ Removing and installing ⇒ Rep. gr. 23

10 - Gasket

- ☐ Renew

11 - Front exhaust pipe with main catalytic converter

- ☐ With flexible joint
- ☐ Removing and installing ⇒ page 266
- ☐ Protect against knocks and impact
- ☐ Do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Mounting components ⇒ page 262
- ☐ Align the exhaust system so it is free of stress ⇒ page 282 .

12 - Clamp (front)

- ☐ Installation position ⇒ page 262
- ☐ Before tightening, align exhaust system so it is free of stress ⇒ page 282
- ☐ Tighten bolt connections evenly

13 - 23 Nm

14 - 25 Nm

- ☐ Renew

15 - Bracket

16 - 23 Nm

17 - 23 Nm

- ☐ Renew

18 - Mounting

19 - Tailpipe

- ☐ Installation position ⇒ page 283

20 - 23 Nm

21 - Rubber mounting

- ☐ Check preload ⇒ „3.2 Stress-free alignment of exhaust system“, page 282

22 - Rear silencer

- ☐ For right side of vehicle
- ☐ Combined with Y-pipe in one unit as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ page 281
- ☐ Align the exhaust system so it is free of stress ⇒ page 282 .

23 - 23 Nm

24 - Rubber mounting

- ☐ Check preload ⇒ „3.2 Stress-free alignment of exhaust system“, page 282

25 - Bolt

26 - Connecting bracket

27 - 23 Nm

28 - Clamp (rear)

- ☐ For separate replacement of Y-pipe and rear silencers
- ☐ Before tightening, align exhaust system so it is free of stress ⇒ page 282
- ☐ Installation position ⇒ page 262
- ☐ Tighten bolt connections evenly

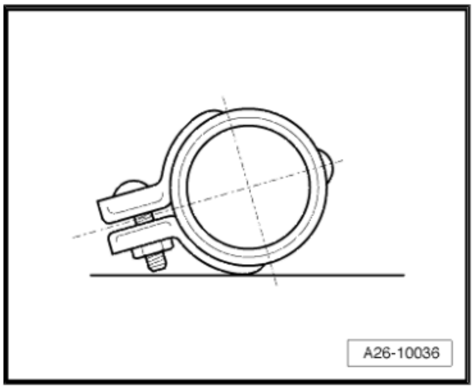
29 - Y-pipe

- ☐ Forms one unit with the rear silencers as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ page 281
- ☐ Align the exhaust system so it is free of stress ⇒ page 282 .

Installation position of front clamp

– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

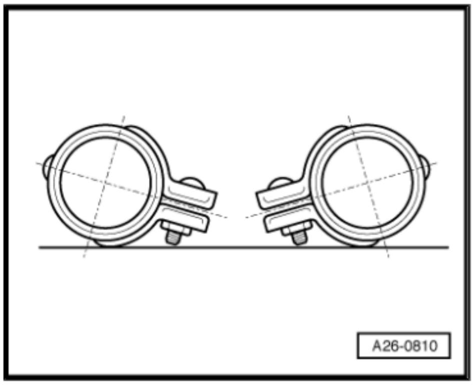
- Bolt connection faces to left.



Installation position of rear clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

- Bolt connections face one another.



Components of mountings for front exhaust pipe

1 - Bolt, 25 Nm

2 - Washer

3 - Compression spring

4 - Spacer sleeve

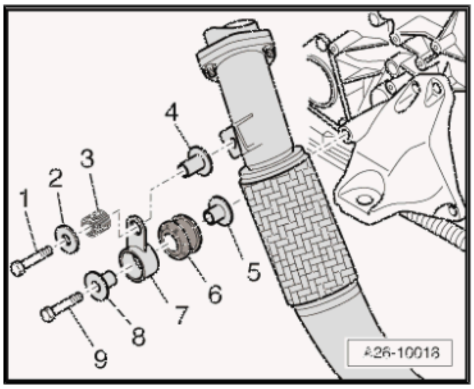
5 - Spacer sleeve

6 - Buffer

7 - Bracket

8 - Spacer sleeve

9 - Bolt, 25 Nm



Components of centre bracket for front exhaust pipe

1 - Bolt, 25 Nm

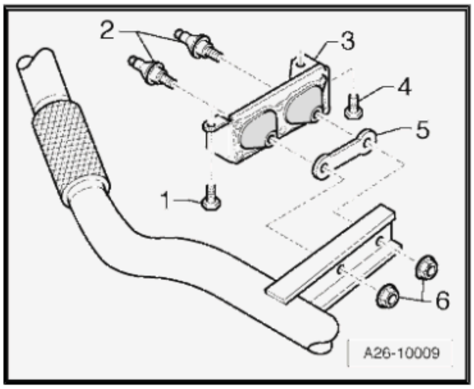
2 - Studs

3 - Bracket

4 - Bolt, 25 Nm

5 - Bracket

6 - Nut, self-locking, 25 Nm



1.2 Removing and installing starter catalytic converter

Removing

Note

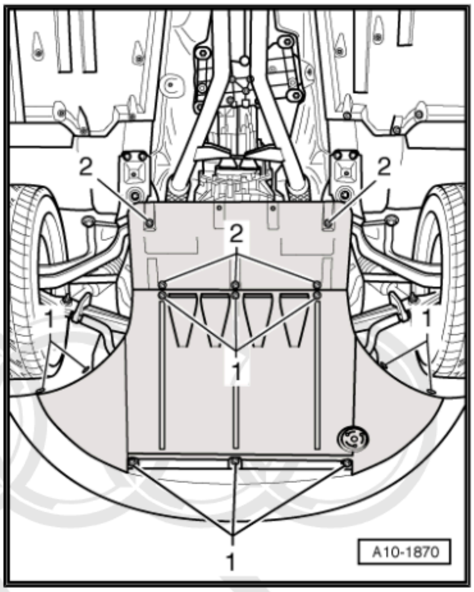
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Remove front left wheel.

Note

Secure brake disc with wheel bolts.

– Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.



– Remove noise insulation in left-side wheel housing -arrows-.

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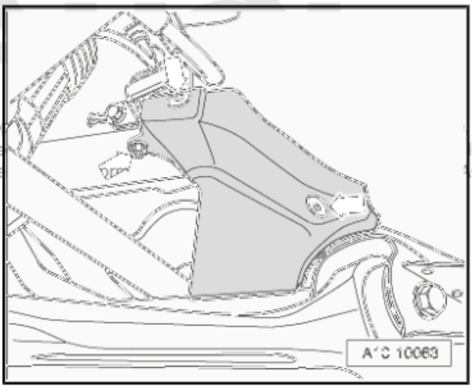
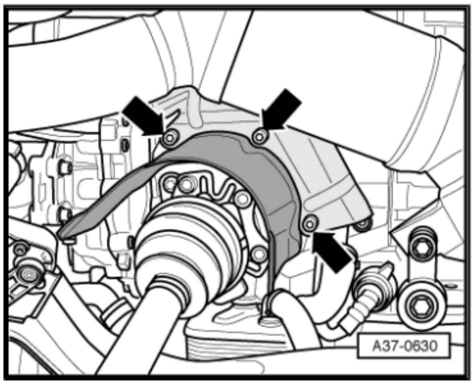


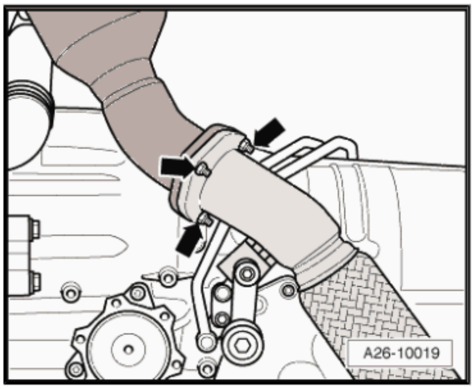
- Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.



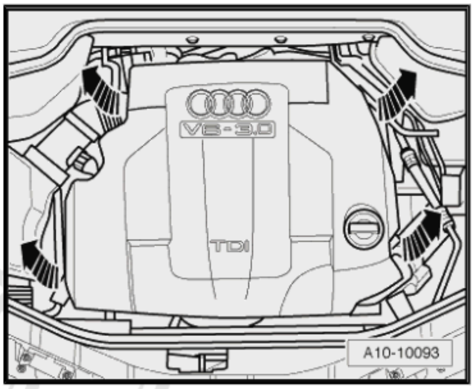
- Unscrew nuts -arrows-.

Note

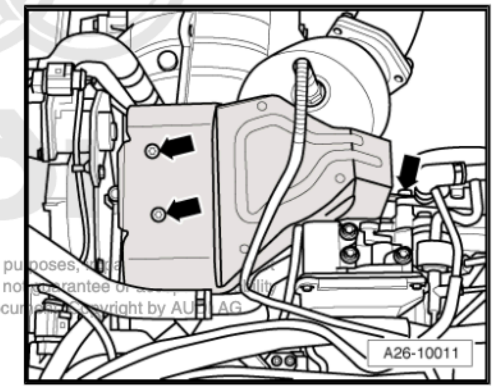
Shown in illustration with engine removed.



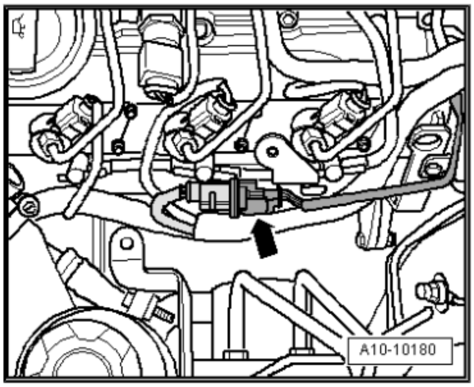
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



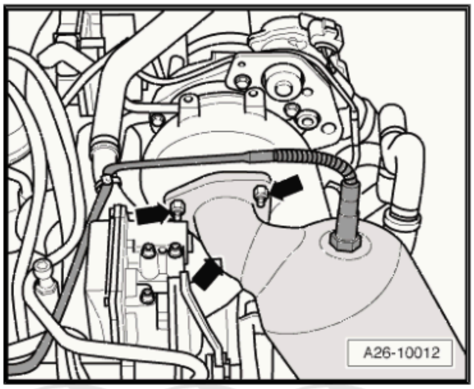
- Remove heat shield for turbocharger -arrows-.



– Unplug electrical connector -arrow- for Lambda probe -G39- and move wiring clear.



– Unscrew nuts -arrows- and remove starter catalytic converter.



Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets and self-locking nuts.*
- *Fit all cable ties in the original positions when installing.*

– Align exhaust system so it is free of stress ⇒ page 282 .

Tightening torques

Component	Nm
Starter catalytic converter to turbocharger	27 1)2)
Heat shield to turbocharger	9
Starter catalytic converter to front exhaust pipe	27 1)
Drive shaft heat shield to gearbox	23
• 1) Renew nuts. • 2) Coat with high-temperature paste; refer to ⇒ Parts catalogue .	

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1.3 Removing and installing front exhaust pipe with main catalytic converter

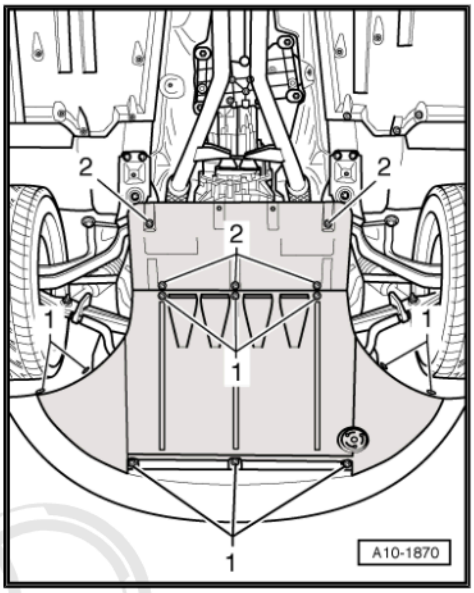
Removing

– Remove front left wheel.

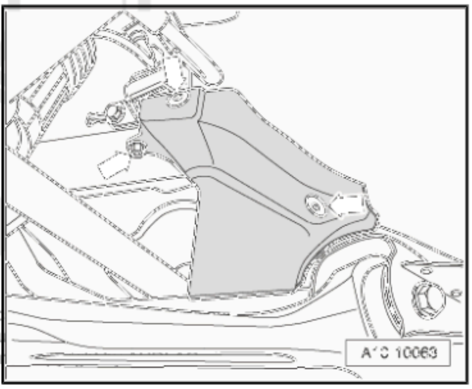
Note

Secure brake disc with wheel bolts.

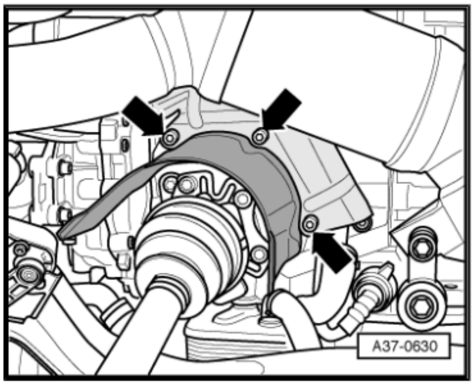
– Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.



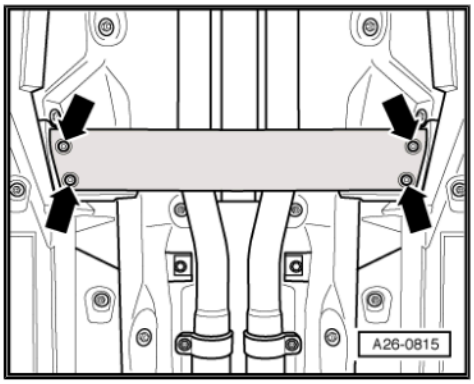
– Remove noise insulation in left-side wheel housing -arrows-.



– Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.



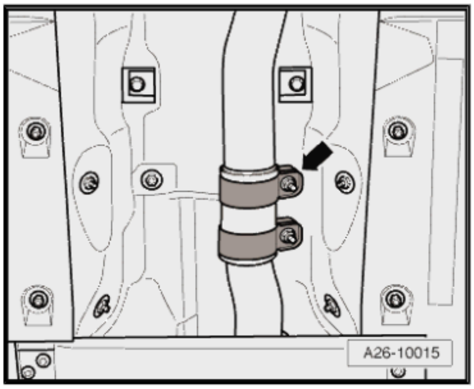
– Remove front cross member -arrows-.



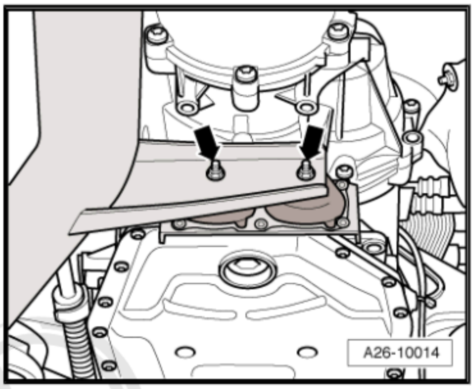
Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

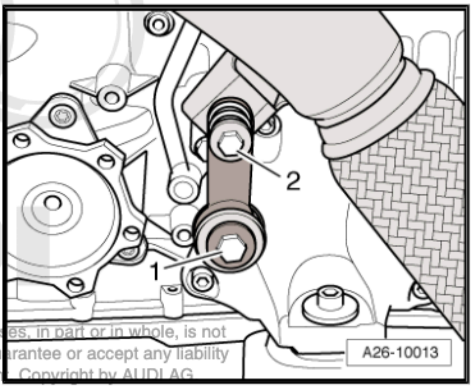
– Disconnect exhaust system at clamp -arrow-.

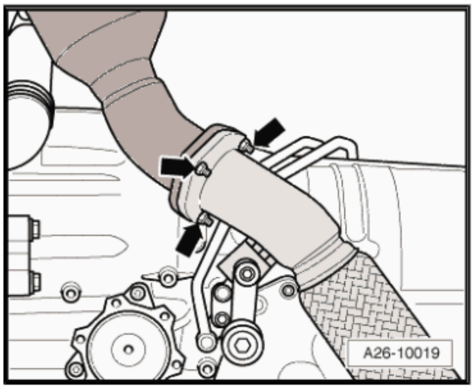


– Remove nuts -arrows- at centre bracket for front exhaust pipe.



– Remove bolts -1- and -2- and detach bracket for front exhaust pipe.





– Remove nuts -arrows- and take out front exhaust pipe with main catalytic converter.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew gaskets and self-locking nuts.

– Align exhaust system so it is free of stress ⇒ page 282 .

Tightening torques

Component		Nm
Front exhaust pipe to starter catalytic converter		27 1)2)
Bracket for front exhaust pipe to:	Gearbox support	25
	Front exhaust pipe	25
Front exhaust pipe to centre bracket		25 1)
Cross member to body		23
Drive shaft heat shield to gearbox		23

- 1) Renew nuts.
- 2) Coat with high-temperature paste; refer to ⇒ Parts catalogue .

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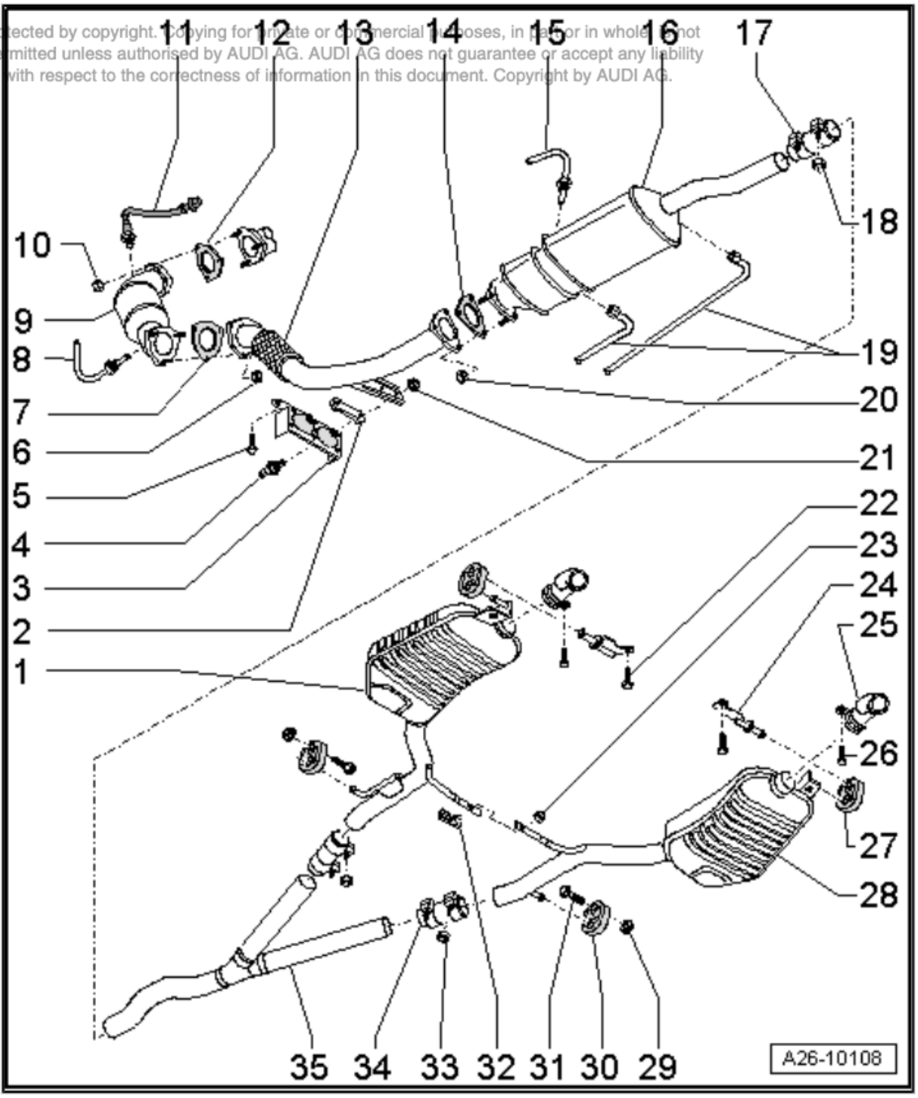
2 Removing and installing parts of exhaust system - vehicles with particulate filter

Note

- *Renew gaskets and self-locking nuts.*
- *After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamps and align silencers and exhaust pipes so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.*
- *After renewing particulate filter, perform adaption in „Guided Functions“ ⇒ Vehicle diagnostic tester*

2.1 Exhaust system - exploded view



1 - Rear silencer
  - For left side of vehicle
  - Combined with Y-pipe in one unit as original equipment. Can be renewed individually for repair purposes
  - Cutting point ⇒ page 281
  - Align exhaust system so it is free of stress ⇒ page 282

2 - Bracket

3 - Centre bracket for front exhaust pipe
  - Mounting components ⇒ page 272

4 - Stud

5 - 25 Nm

6 - 27 Nm
  - Renew
  - Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

7 - Gasket
  - Renew

8 - Exhaust gas temperature sender 2 for cylinder bank 1 -G448-
  - Removing and installing ⇒ page 297

9 - Starter catalytic converter
  - Removing and installing ⇒ page 272

- ☐ Protect against knocks and impact
- ☐ Align exhaust system so it is free of stress ⇒ page 282

10 - 27 Nm

- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

11 - Lambda probe -G39-

- ☐ The threads on the new Lambda probes are coated with a special assembly paste.
- ☐ If re-installing old Lambda probe, coat thread with high-temperature paste: Refer to ⇒ Parts catalogue for high-temperature paste.
- ☐ The assembly paste/high-temperature paste must not get into the slots on the probe body.
- ☐ Removing and installing ⇒ Rep. gr. 23

12 - Gasket

- ☐ Renew

13 - Front exhaust pipe

- ☐ With flexible joint
- ☐ Removing and installing ⇒ page 275
- ☐ Do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Mounting components ⇒ page 272
- ☐ Align exhaust system so it is free of stress ⇒ page 282

14 - Gasket

- ☐ Renew

15 - Temperature sender before particulate filter -G506-

- ☐ Removing and installing ⇒ page 296

16 - Particulate filter with main catalytic converter

- ☐ Removing and installing ⇒ page 278
- ☐ After renewing particulate filter, perform adaption in „Guided Functions“ ⇒ Vehicle diagnostic tester.

17 - Clamp (front)

- ☐ Installation position ⇒ page 271
- ☐ Before tightening, align exhaust system so it is free of stress ⇒ page 282
- ☐ Tighten bolt connections evenly

18 - 23 Nm

19 - Pressure pipes

- ☐ Tighten union nuts to 30 Nm.

20 - 27 Nm

- ☐ Renew

21 - 25 Nm

- ☐ Renew

22 - 23 Nm

23 - 23 Nm

- ☐ Renew

24 - Mounting

25 - Tailpipe

- ☐ Installation position ⇒ page 283

26 - 23 Nm

27 - Rubber mounting

- ☐ Check preload ⇒ „3.2 Stress-free alignment of exhaust system“, page 282

28 - Rear silencer

☐ For right side of vehicle

☐ Combined with Y-pipe in one unit as original equipment. Can be renewed individually for repair purposes

☐ Cutting point ⇒ page 281

☐ Align exhaust system so it is free of stress ⇒ page 282

29 - 23 Nm

30 - Rubber mounting

☐ Check preload ⇒ „3.2 Stress-free alignment of exhaust system“, page 282

31 - Bolt

32 - Connecting bracket

33 - 23 Nm

34 - Clamp (rear)

☐ For separate replacement of Y-pipe and rear silencers

☐ Before tightening, align exhaust system so it is free of stress

☐ Installation position ⇒ page 271

☐ Tighten bolt connections evenly

35 - Y-pipe

☐ Forms one unit with the rear silencers as original equipment. Can be renewed individually for repair purposes

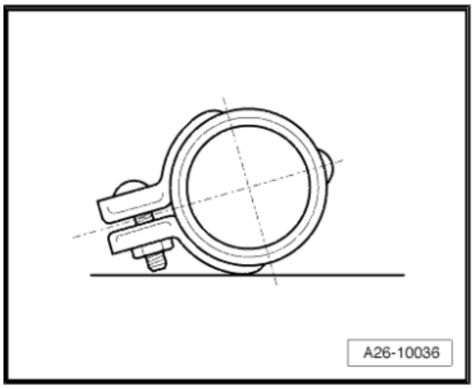
☐ Cutting point ⇒ page 281

☐ Align exhaust system so it is free of stress ⇒ page 282

Installation position of front clamp

– Install clamp so that ends of bolts do not protrude beyond bottom of clamp.

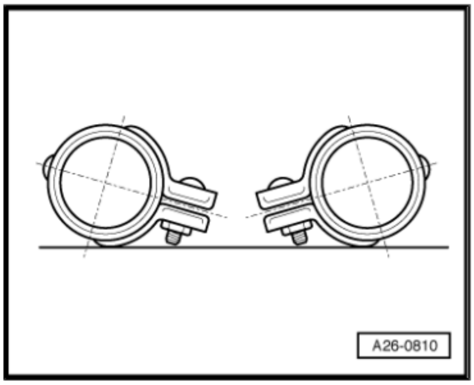
- Bolt connection faces to left.



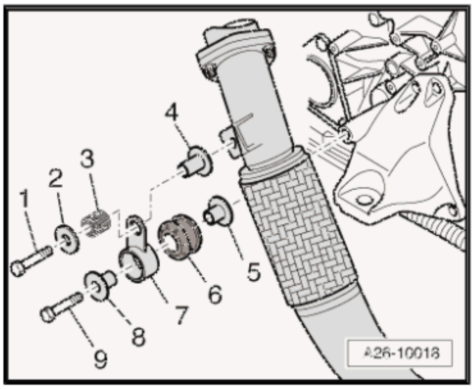
Installation position of rear clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

- Bolt connections face one another.



Components of mountings for front exhaust pipe



1 - Bolt, 25 Nm

2 - Washer

3 - Compression spring

4 - Spacer sleeve

5 - Spacer sleeve

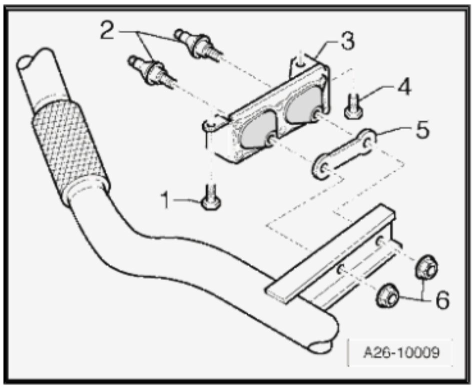
6 - Buffer

7 - Bracket

8 - Spacer sleeve

9 - Bolt, 25 Nm

Components of centre bracket for front exhaust pipe



1 - Bolt, 25 Nm

2 - Studs

3 - Bracket

4 - Bolt, 25 Nm

5 - Bracket

6 - Nut, self-locking, 25 Nm

2.2 Removing and installing starter catalytic converter

Removing

Note

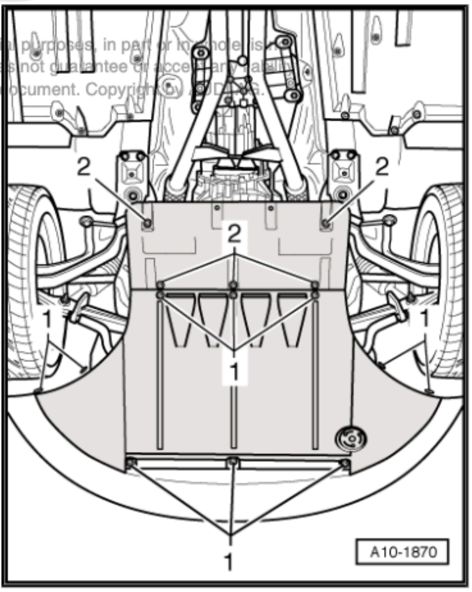
- ♦ *Fit all heat insulation sleeves in the original position when installing.*
- ♦ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*

– Remove front left wheel.

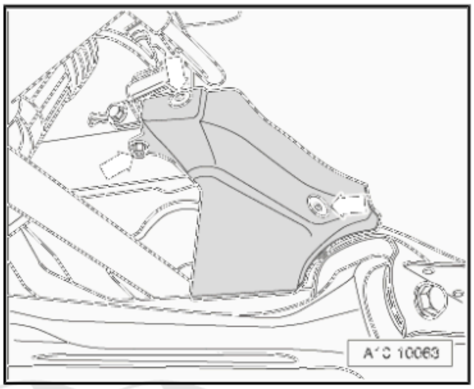
Note

Secure brake disc with wheel bolts.

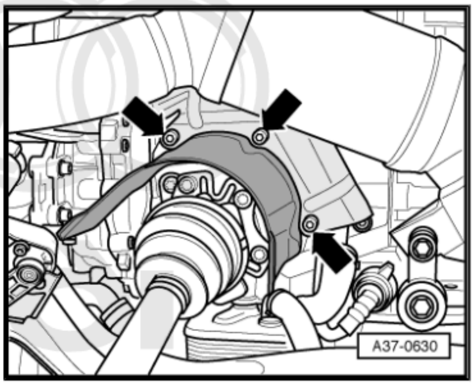
– Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.



- Remove noise insulation in left-side wheel housing -arrows-.



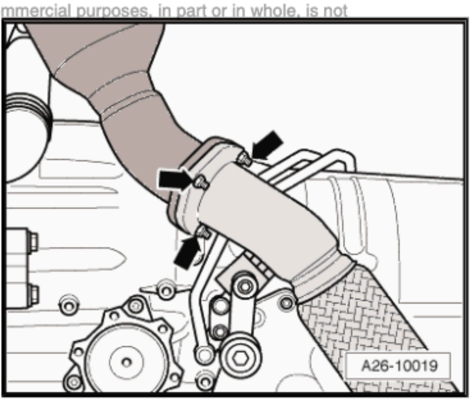
- Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.



- Unscrew nuts -arrows-.

Note

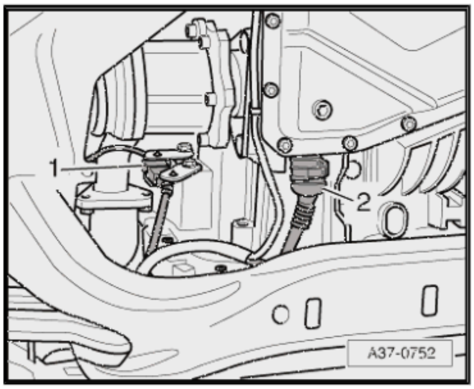
Shown in illustration with engine removed.



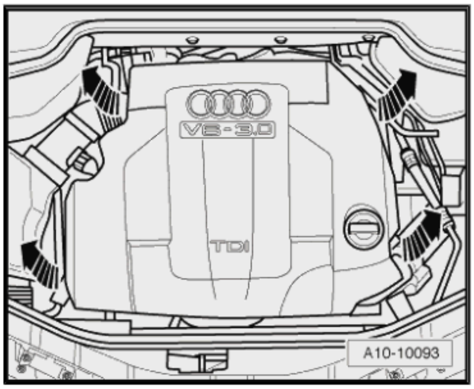
- Unplug electrical connector for exhaust gas temperature sender 2 for bank 1 -G448- above electrical connector for engine speed sender -G28- -item 1-.
- Move wiring clear.

Note

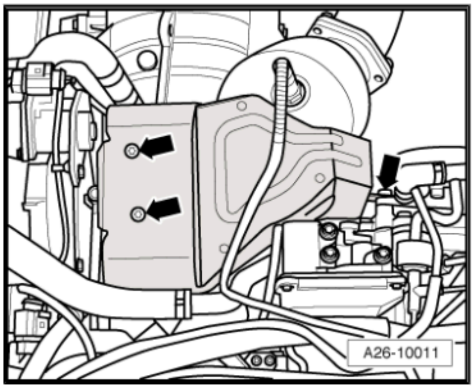
Disregard -item 2-.



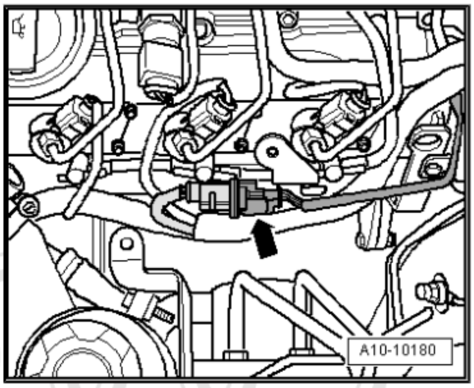
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

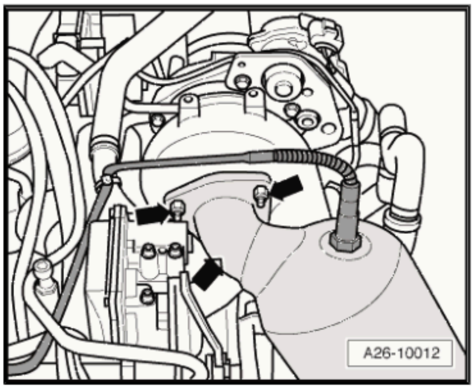


- Remove heat shield for turbocharger -arrows-.



- Unplug electrical connector -arrow- for Lambda probe -G39- and move wiring clear.





- Unscrew nuts -arrows- and remove starter catalytic converter.

Installing

Installation is carried out in the reverse order; note the following:

Note

- ♦ *Renew gaskets and self-locking nuts.*
- ♦ *Reinstall heat insulation sleeves in the same locations when assembling.*
- ♦ *Fit all cable ties in the original positions when installing.*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

- Align exhaust system so it is free of stress ⇒ page 282 .

Tightening torques

Component	Nm
Starter catalytic converter to turbocharger	27 1)2)
Heat shield to turbocharger	9
Starter catalytic converter to front exhaust pipe	27 1)
Drive shaft heat shield to gearbox	23
• 1) Renew nuts. • 2) Coat with high-temperature paste; refer to ⇒ Parts catalogue .	

2.3 Removing and installing front exhaust pipe

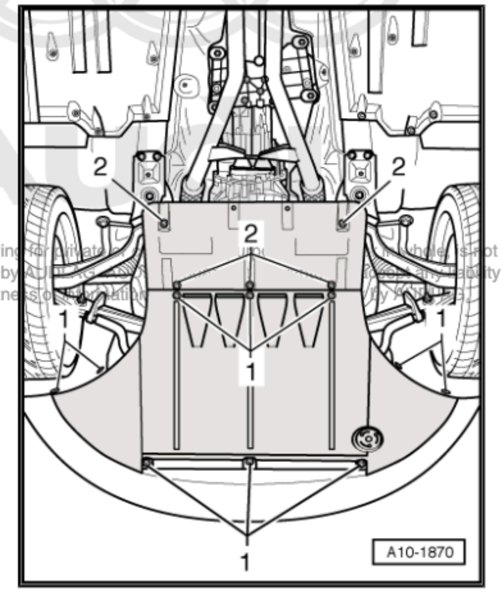
Removing

- Remove front left wheel.

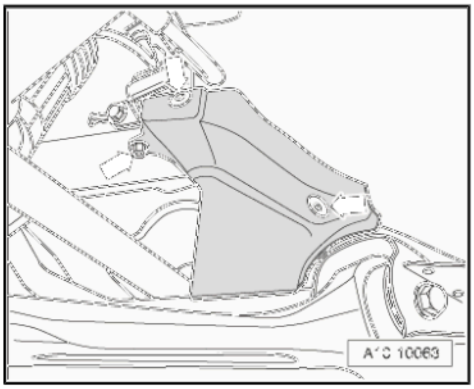
Note

Secure brake disc with wheel bolts.

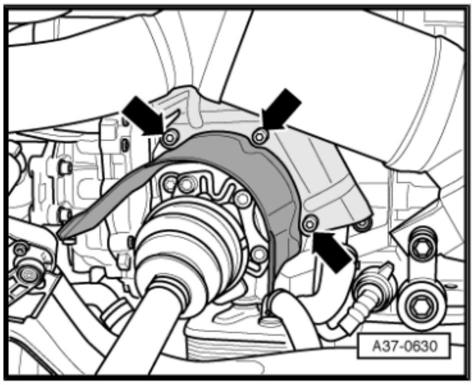
- Release quick-release fasteners -1- and -2- and take off front and rear noise insulation.



- Remove noise insulation in left-side wheel housing -arrows-.



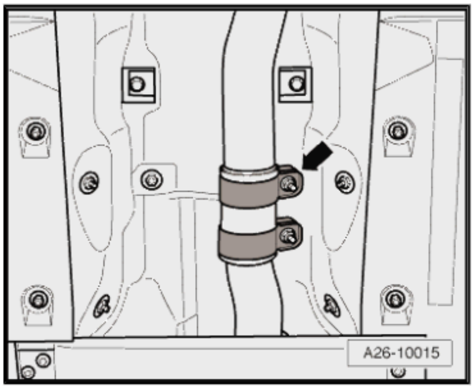
- Unbolt heat shield above drive shaft (left-side) from gearbox -arrows-.



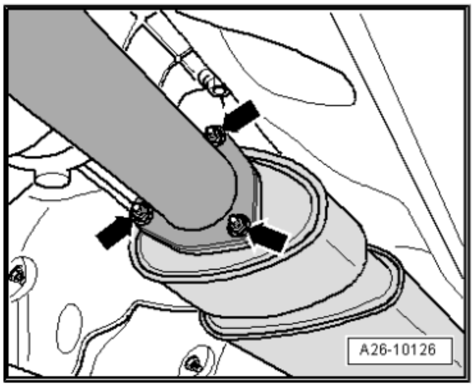
Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.

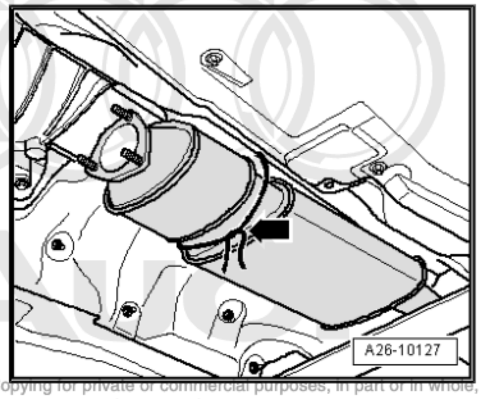
- Disconnect exhaust system at clamp -arrow- and push clamp forwards.



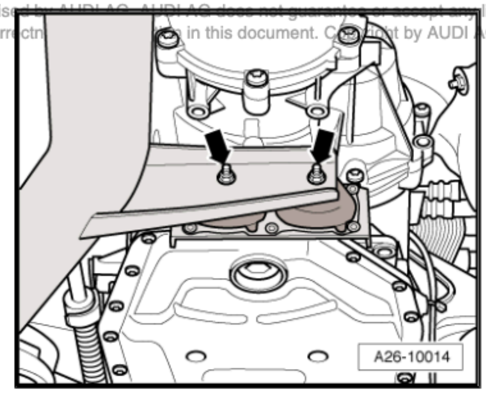
- Unscrew nuts -arrows-.



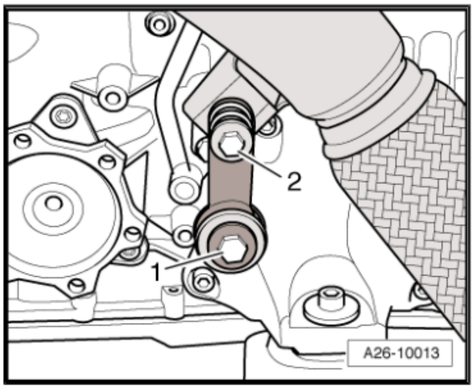
- Tie up particulate filter to propshaft -arrow- and separate exhaust system at the flange.



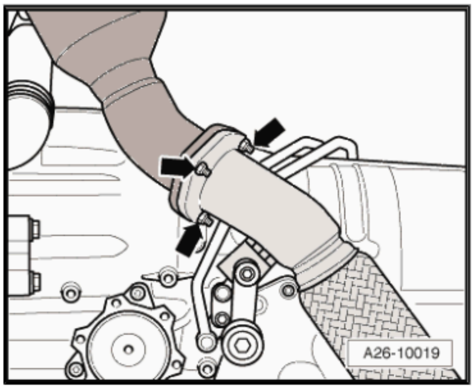
- Remove nuts -arrows- at centre bracket for front exhaust pipe.



- Remove bolts -1- and -2- and detach bracket for front exhaust pipe.



– Unscrew nuts -arrows- and remove front exhaust pipe.



Installing

Installation is carried out in the reverse order; note the following:

Note

Renew gaskets and self-locking nuts.

– Align exhaust system so it is free of stress ⇒ page 282 .

Tightening torques

Component		Nm
Front exhaust pipe to starter catalytic converter		27 1)2)
Bracket for front exhaust pipe to:	Gearbox support	25
	Front exhaust pipe	25
Front exhaust pipe to:	Centre bracket	25 1)
	Particulate filter	27 1)
Drive shaft heat shield to gearbox		23

- 1) Renew nuts.
- 2) Coat with high-temperature paste; refer to ⇒ Parts catalogue .

2.4 Removing and installing particulate filter with main catalytic converter

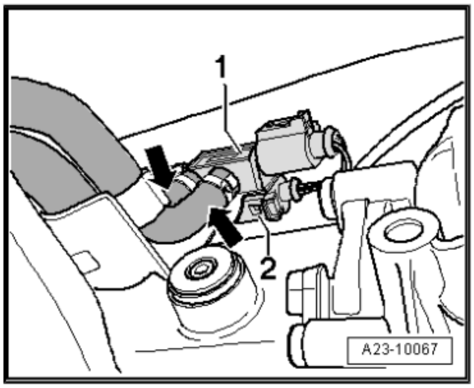
Removing

Note

- ◆ *Fit all heat insulation sleeves in the original position when installing.*
- ◆ *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*

– Disengage the electrical connector -2- from retainer at gearbox (right-side).

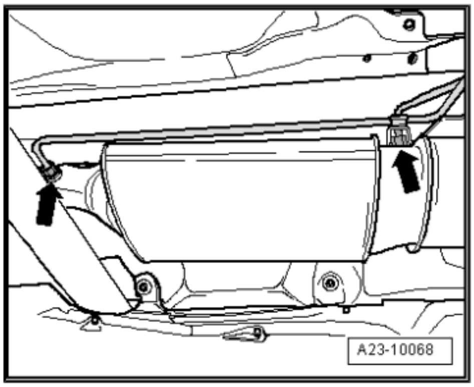
– Unplug electrical connector and move wiring clear.



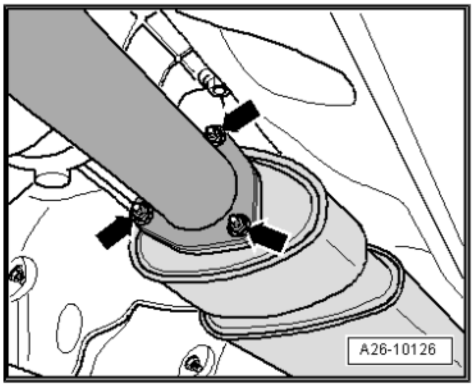
Note

Ignore items marked -1- and -arrows-.

- Unscrew pressure pipes -arrows- from particulate filter.

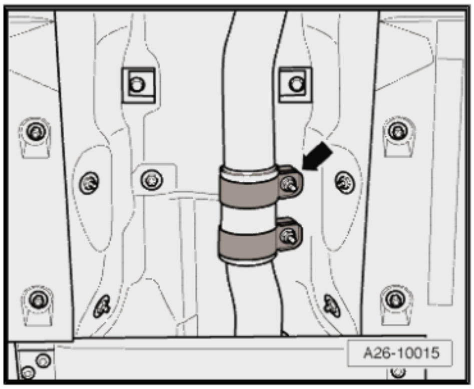


- Unscrew nuts -arrows-.



Note

To avoid any damage, the flexible joint in the front exhaust pipe must not be bent more than 10°.



– Disconnect exhaust system at clamp -arrow-.

– Detach particulate filter with main catalytic converter.

Installing

Installation is carried out in the reverse order; note the following:

Note

- *Reinstall heat insulation sleeves in the same locations when assembling.*
- *Fit all cable ties in the original positions when installing.*

– Align exhaust system so it is free of stress ⇒ page 282 .

– After renewing particulate filter, perform adaption in „Guided Functions“ ⇒ Vehicle diagnostic tester

Tightening torques

Component	Nm
Particulate filter with main catalytic convertor to front exhaust pipe	27 1)2)
Pressure pipes to particulate filter	30
• 1) Renew nuts. • 2) Coat with high-temperature paste; refer to ⇒ Parts catalogue .	

3 Servicing exhaust system

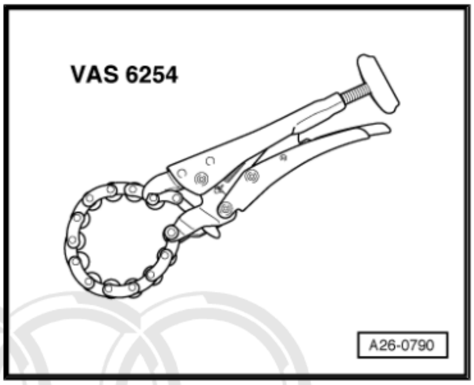
3.1 Separating Y-pipe and rear silencers

The connecting pipe can be cut through at the point marked in order to renew the Y-pipe and rear silencers separately.

The cutting point is marked by an indentation on the outside of the exhaust pipe.

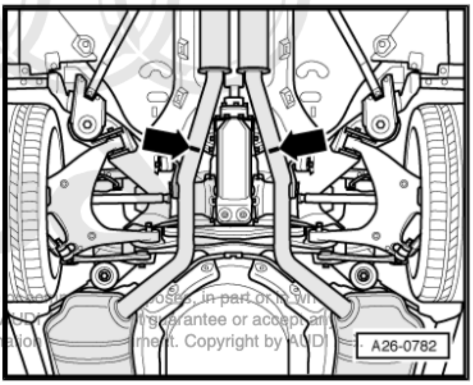
Special tools and workshop equipment required

- Chain pipe cutter -VAS 6254-

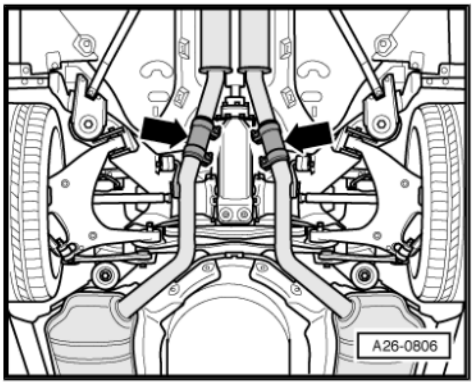


Procedure

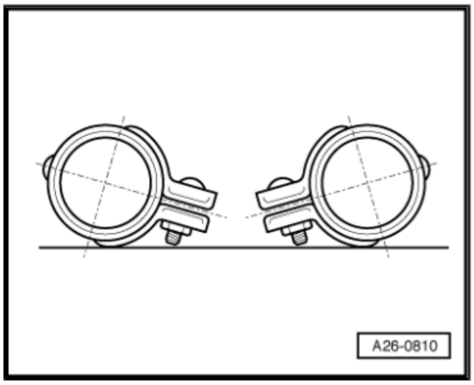
- Cut through exhaust pipes at right angles at the position marked -arrows- using chain pipe cutter -VAS 6254-



- When installing, position centre of clamps -arrows- over cutting location.



- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolt connections face one another.
- Align exhaust system so it is free of stress ⇒ page 282 .

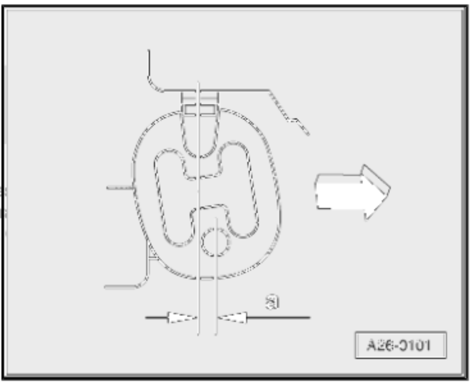


3.2 Stress-free alignment of exhaust system

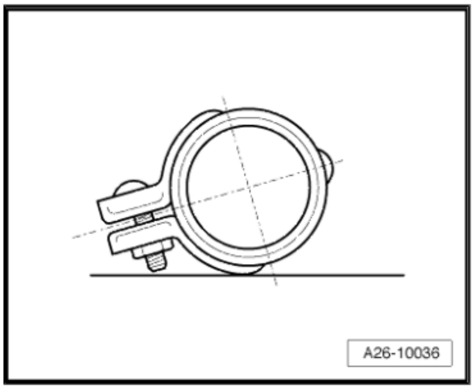
Note

The exhaust system must be aligned when it is cool.

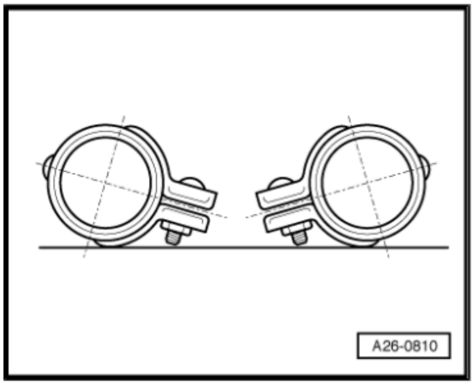
- Loosen bolt connections of all exhaust system clamps.
- Push rear silencers forwards -arrow- until preload at rubber mountings is as follows:
- Rubber mounting (front): -a- = 11 mm.
- Rubber mounting (rear): -a- = 14 mm.
- Align rear silencer horizontally.
- Position clamps so that they align with centre of cutting locations.



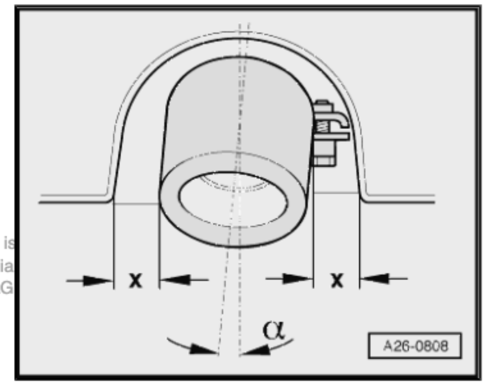
- Align front clamp so that ends of bolts do not protrude beyond bottom of clamp.



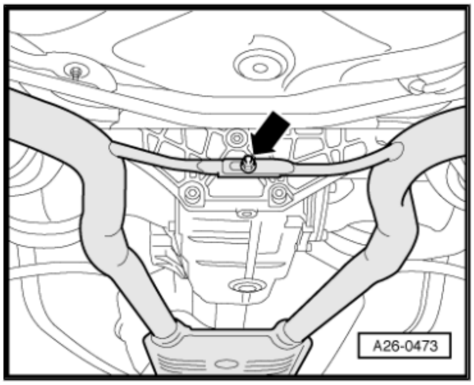
- Align rear clamps so that ends of bolts do not protrude beyond bottom of clamps.
- Tighten bolts on clamps evenly to 23 Nm.



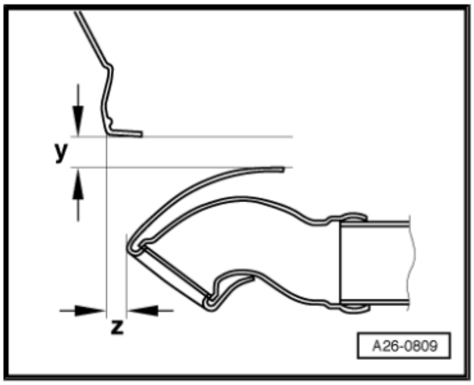
3.3 Aligning tailpipes



- – Check the spacing of the left and right side tailpipes to the bumper cover:
- • Dimension -x- (left-side) = dimension -x- (right-side); tolerance max. 2 mm.
- – Check alignment angle of left and right-side tailpipes (sideways inclination)
- • Angle -α- = 5°
- – To correct angle -α-, loosen clamping bolt on tailpipe and turn tailpipe as required.
- – Tighten clamping bolt to 30 Nm.



- – To correct dimension „x“, loosen nut -arrow- on strut between exhaust pipes.
- – Adjust the distance between the rear silencers.
- – Tighten nut to 23 Nm.



- – Check distances -y- and -z- between tailpipes and bumper cover.
- • Dimension -y- = 10 ... 14 mm.
- • Dimension -z- = 13 ... 17 mm.

3.4 Checking exhaust system for leaks

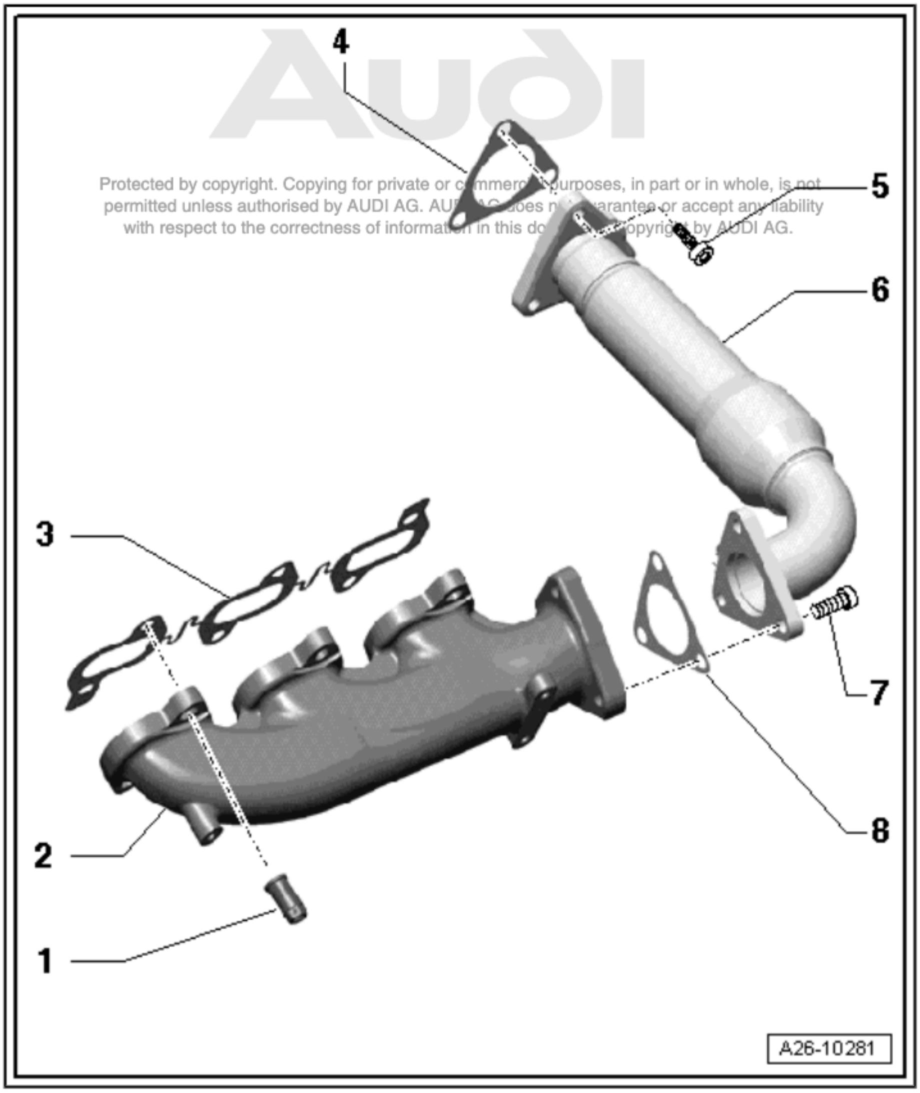
- – Start engine and run at idling speed.
- – Plug tailpipes during leak test (e.g. with cloth or plug).
- – Listen for leaks at joints between cylinder head/exhaust manifold, exhaust manifold/intermediate pipe, intermediate pipe/intermediate flange, intermediate flange/turbocharger, etc.
- – Repair any leaks that are found.

4 Removing and installing exhaust manifolds and intermediate pipes

4.1 Exhaust manifold - exploded view

Note

Illustration shows exhaust manifold of cylinder bank 2 (left-side) with intermediate pipe.



1 - 25 Nm

- ☐ Renew
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

2 - Exhaust manifold

- ☐ Removing and installing: left-side ⇒ page 285 , right-side ⇒ page 287

3 - Gasket

- ☐ Renew

4 - Gasket

- ☐ Renew

5 - 30 Nm + 90° (${}^{1}/_{4}$ turn) further

- ☐ Renew
- ☐ Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

6 - Intermediate pipe

- ☐ Removing and installing: left-side ⇒ page 292 , right-side ⇒ page 294

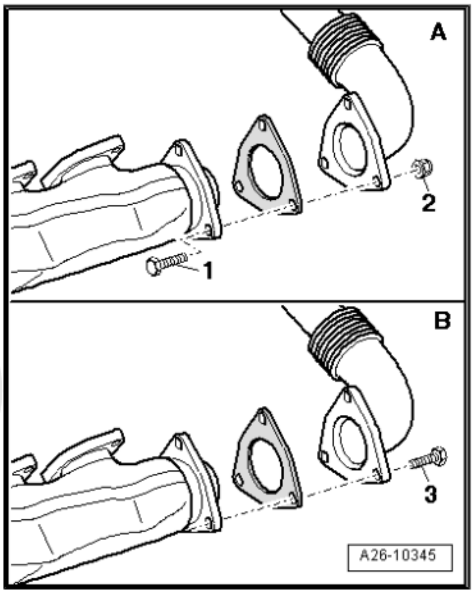
7 - 30 Nm + 90° (${}^{1}/_{4}$ turn) further

- ☐ Type of connection differs depending on version ⇒ page 285

8 - Gasket

- ☐ Renew

Securing intermediate pipe to exhaust manifold



A - Exhaust manifold (sheet metal version)

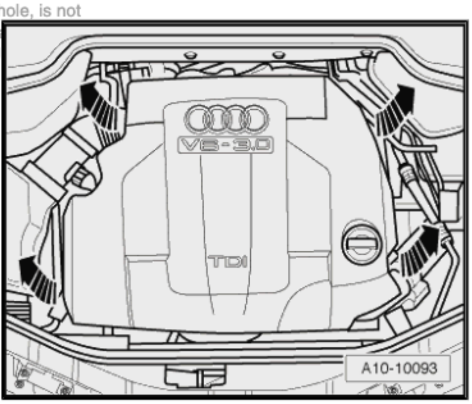
- Fitted with bolts -1- and nuts -2-.
- Renew bolts and nuts.
- Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

B - Exhaust manifold (cast version)

- Fitted with bolts -3-.
- Renew bolts.
- Coat with high-temperature lubricant; for high-temperature lubricant refer to ⇒ Parts catalogue

4.2 Removing and installing exhaust manifold (left-side)

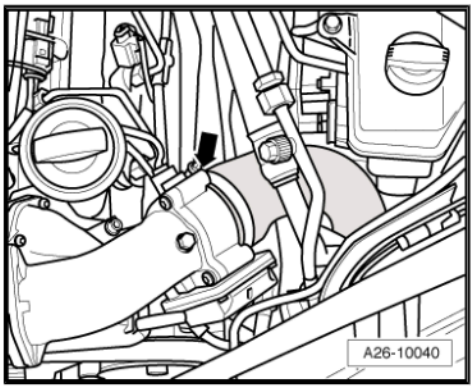
Removing



Note

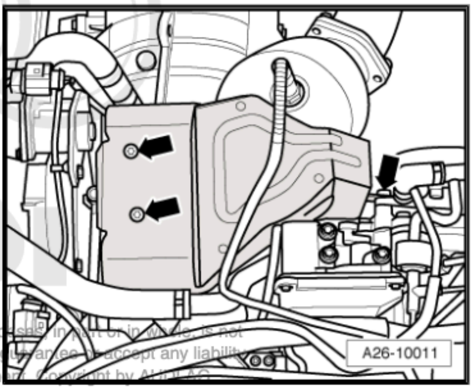
All cable ties which are released or cut open when removing must be refitted in the same position when installing.

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

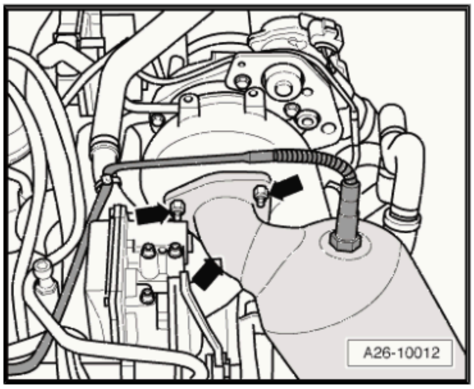


– Disconnect air intake hose from intake connecting pipe -arrow-.

- Remove heat shield for turbocharger -arrows-.



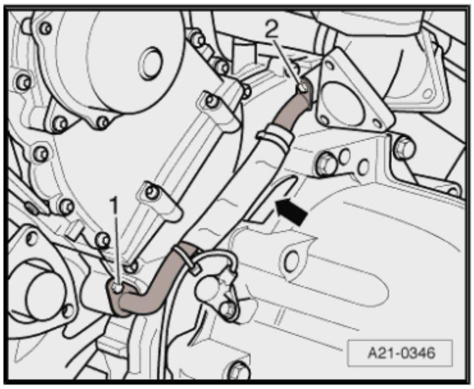
- Unscrew nuts -arrows- at starter catalytic converter.



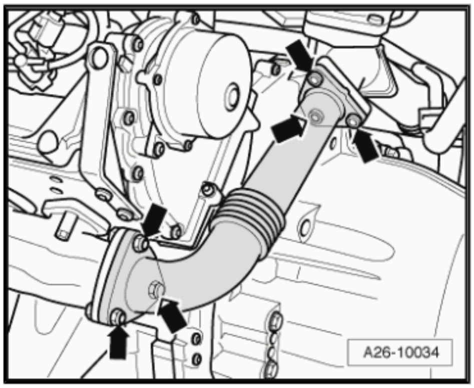
- Cover opening -arrow- in gearbox to prevent small parts from dropping in.
- Unscrew bolts -1- and -2- and detach oil return line.

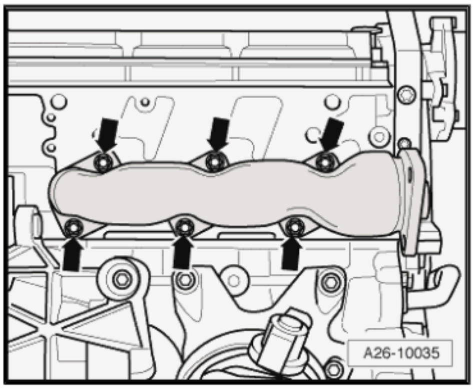
Note

Shown in illustration with engine removed and intermediate pipe detached.



- Unscrew nuts and bolts -arrows- and detach intermediate pipe.





– Unbolt exhaust manifold -arrows-.

Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets, O-rings and self-locking nuts.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- *Reinstall all cable ties in the same locations when assembling.*

Tightening torques

Component		Nm
Exhaust manifold to cylinder head		25 1)
Intermediate pipe to:	Exhaust manifold	30 + 90° 1)2)3)
	Intermediate flange	30 + 90° 1)2)3)
Oil return pipe to:	Cylinder block	9
	Intermediate flange	9
Starter catalytic converter to turbocharger		27 1)2)
Heat shield to turbocharger		9
Hose clips (13 mm wide)		5.5

- 1) Renew nuts/bolts.
- 2) 90° = one quarter turn.
- 3) Coat with high-temperature paste; refer to ⇒ Parts catalogue .

4.3 Removing and installing exhaust manifold (right-side)

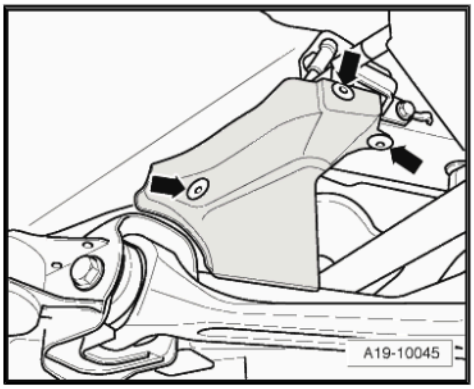
Removing

– Remove front right wheel.

Note

Secure brake disc with wheel bolts.

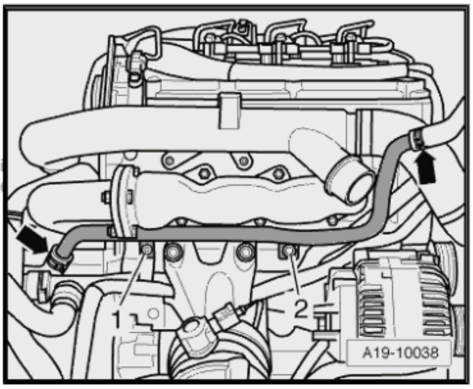
- Remove noise insulation in right-side wheel housing -arrows-.
- Unbolt drive shaft (right-side) from gearbox flange.



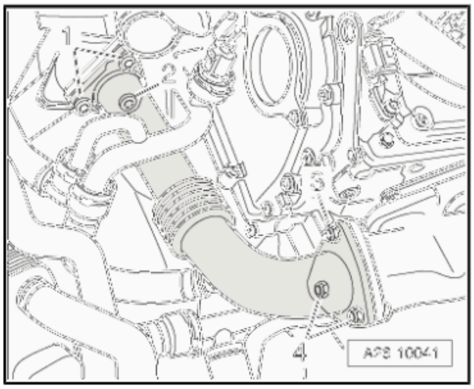
- Unscrew bolts -1- and -2- securing coolant pipe (right-side); leave coolant hoses -arrows- connected.

Note

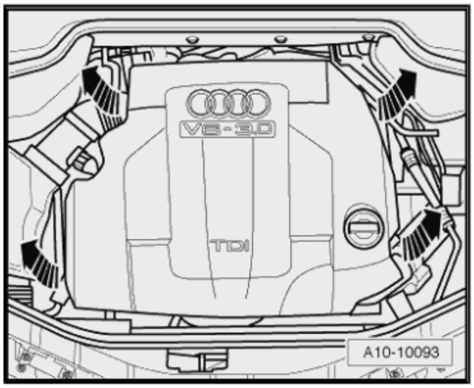
Shown in illustration with engine removed.



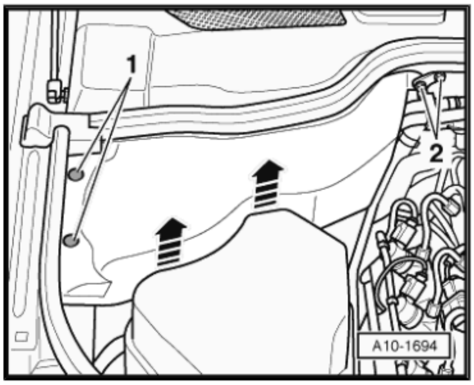
- Unscrew bolts and nuts -2- and -4- (accessible from below) securing intermediate pipe.



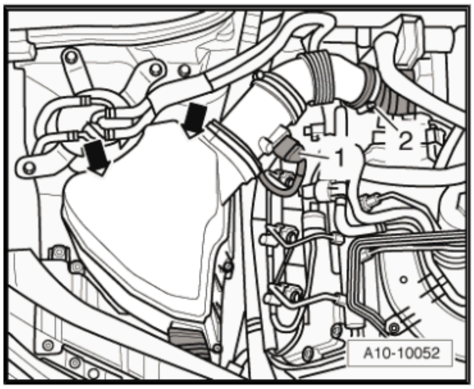
- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



- Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- Pull cover out of retainers -arrows-.

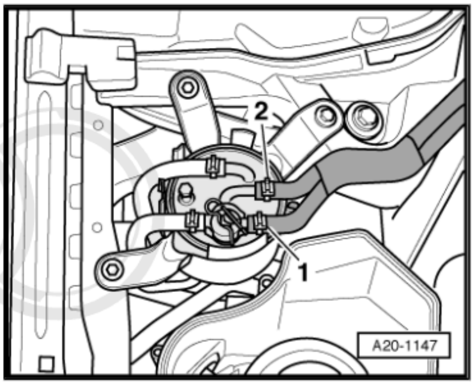


- Detach air intake hose -2- at turbocharger.
- Detach electrical connector at air mass meter -G70- .
- Remove bolts -arrows-.
- Take out air cleaner housing.

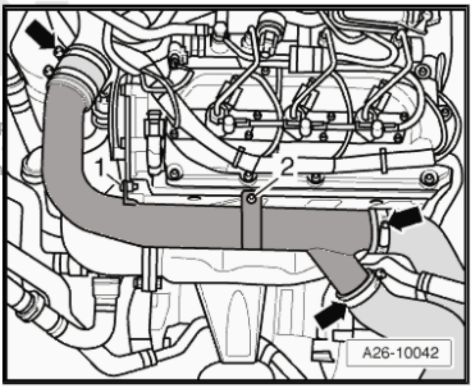


WARNING

Rules for cleanliness when working on the injection system ⇒ page 6 .

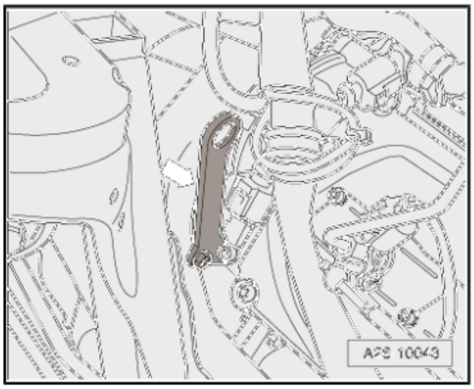


- Disconnect fuel return pipe -1- and fuel supply pipe -2- from fuel filter.

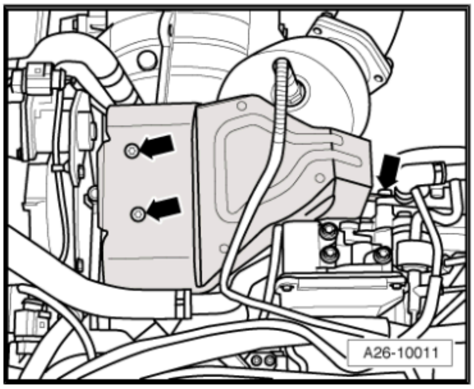


- Unscrew bolts -1- and -2- and initially disconnect air pipe from hoses.

- Unbolt engine lifting eye -arrow- from cylinder head.
- Take out air pipe.



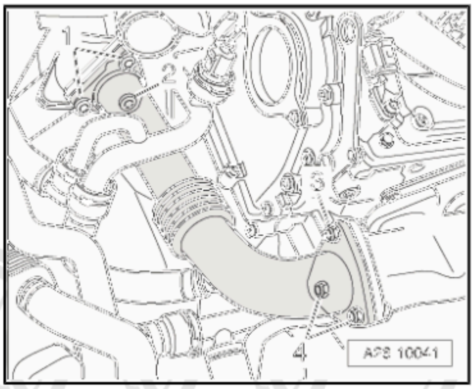
- Remove heat shield for turbocharger -arrows-.



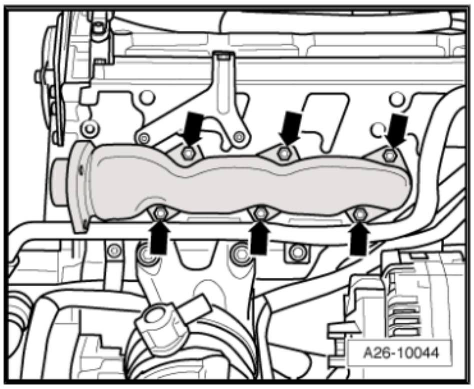
- Unscrew bolts and nuts -1- and -3- (accessible from above).

Note

Shown in illustration with engine removed.



- Unbolt exhaust manifold -arrows- and take out together with intermediate pipe.



Installing

Installation is carried out in the reverse order; note the following:

Note

- ♦ *Renew gaskets and self-locking nuts.*
- ♦ *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ♦ *To ensure that the charge air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*
- ♦ *Reinstall all cable ties in the same locations when assembling.*

- Install drive shaft (right-side) ⇒ Rep. gr. 40 .

Tightening torques

Component		Nm
Exhaust manifold to cylinder head		25 [1)2)]
Intermediate pipe to:	Exhaust manifold	30 + 90° [1)2)3)]
	Intermediate flange	30 + 90° [1)2)3)]
Heat shield for turbocharger		9
Air pipe to:	Bracket	9
	Engine lifting eye	9
Clamp for wiring harness to cylinder head cover		9
Coolant pipe (top) to engine	M6	9
	M8	22
Engine lifting eye to cylinder head	M6	9
	M8	25
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

- [1)] Renew nuts/bolts.
- [2)] 90° = one quarter turn.
- [3)] Coat with high-temperature paste; refer to ⇒ Parts catalogue .

4.4 Removing and installing intermediate pipe (left-side)

Removing

Note

All cable ties which are released or cut open when removing must be refitted in the same position when installing.

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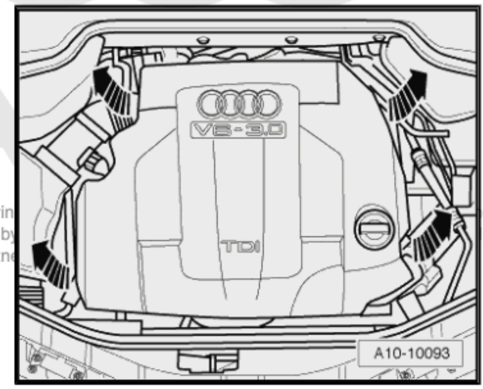
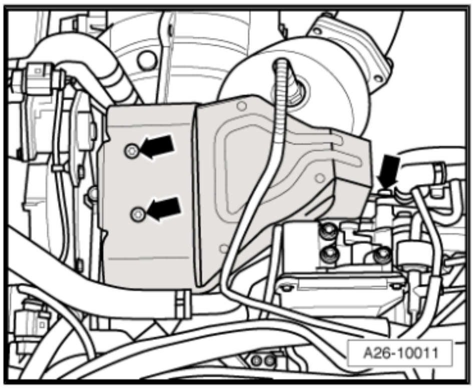
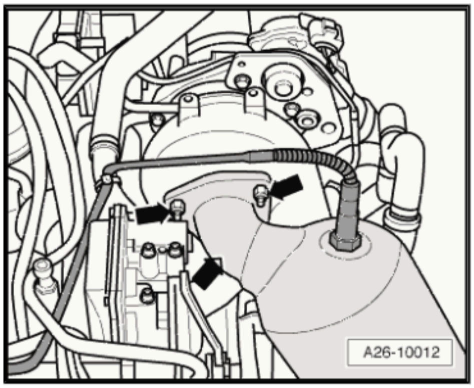
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Remove heat shield for turbocharger -arrows-.

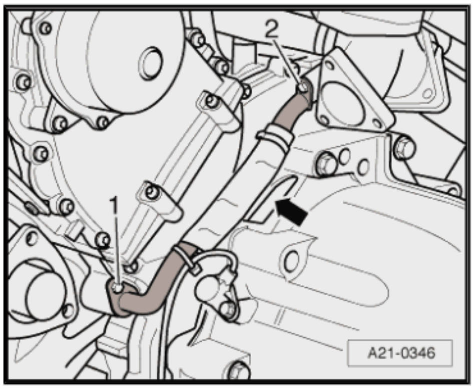


– Unscrew nuts -arrows- at starter catalytic converter.



– Cover opening -arrow- in gearbox to prevent small parts from dropping in.

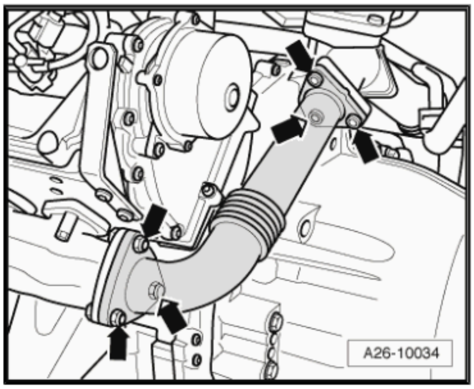
– Unscrew bolts -1- and -2- and detach oil return line.



Note

Shown in illustration with engine removed and intermediate pipe detached.

– Unbolt intermediate pipe -arrows-.



Installing

Installation is carried out in the reverse order; note the following:

Note

- ♦ *Renew gaskets, O-rings and self-locking nuts.*
- ♦ *Reinstall all cable ties in the same locations when assembling.*

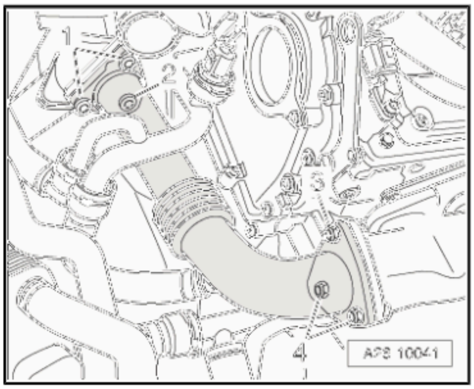
Tightening torques

Component		Nm
Intermediate pipe to:	Exhaust manifold	30 + 90° 1)2)3)
	Intermediate flange	30 + 90° 1)2)3)
Oil return pipe to:	Cylinder block	9
	Intermediate flange	9
Starter catalytic converter to turbocharger		27 1)2)
Heat shield to turbocharger		9

- 1) Renew nuts/bolts.
- 2) 90° = one quarter turn.
- 3) Coat with high-temperature paste; refer to ⇒ Parts catalogue .

4.5 Removing and installing intermediate pipe (right-side)

Removing



- Drain off coolant ⇒ page 202 .
- Remove coolant pipe (rear) ⇒ page 228 .
- Unscrew bolts -1- and -2- and nuts -3- and -4- and take off intermediate pipe.

Note

Shown in illustration with engine removed.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seals and gaskets.

- Install coolant pipe (rear) ⇒ page 228 .
- Fill cooling system ⇒ page 204 .

Tightening torques

Component		Nm
Intermediate pipe to:	Exhaust manifold	30 + 90° 1)2)3)
	Intermediate flange	30 + 90° 1)2)3)

- 1) Renew nuts/bolts.
- 2) 90° = one quarter turn.
- 3) Coat with high-temperature paste; refer to ⇒ Parts catalogue .

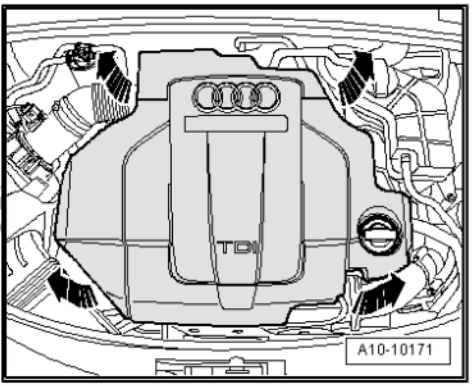
5 Removing and installing parts of exhaust gas temperature control

5.1 Removing and installing exhaust gas temperature sender 1 -G235-

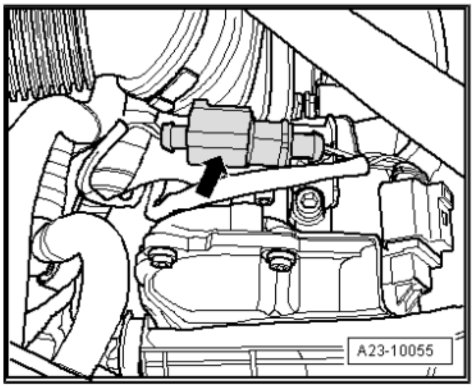
Removing

Note

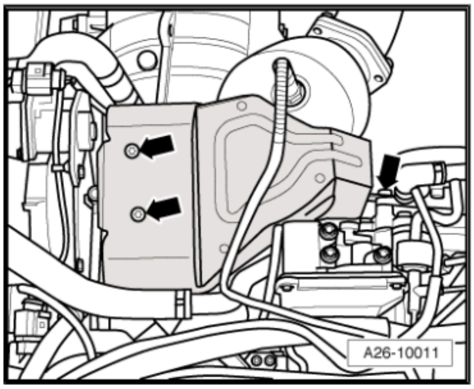
All cable ties which are released or cut open when removing must be fitted in the same position when installing.



- Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

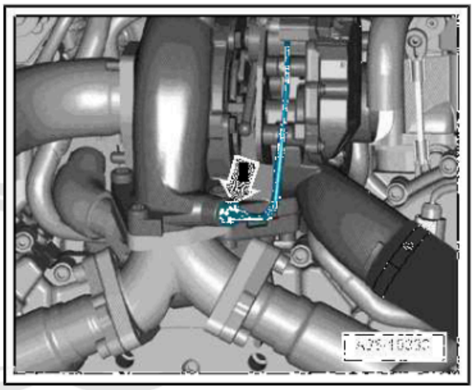


- Unplug electrical connector -arrow- for exhaust gas temperature sender 1 -G235- and move wiring clear.



- Remove heat shield for turbocharger -arrows-.

- Unscrew exhaust gas temperature sender 1 -G235- -arrow-.



Note

Shown from rear with engine removed for illustration purposes.

Installing

Installation is carried out in the reverse order; note the following:

Note

Fit all cable ties in the original positions when installing.

- Installation position: connection for exhaust gas temperature sender 1 -G235- faces upwards.

Tightening torques

Component		Nm
Exhaust gas temperature sender 1 -G235- to turbocharger		45 [1]
Heat shield to:	Turbocharger	9
	Cylinder head	9
- [1] Coat with high-temperature paste; refer to ⇒ Parts catalogue .		

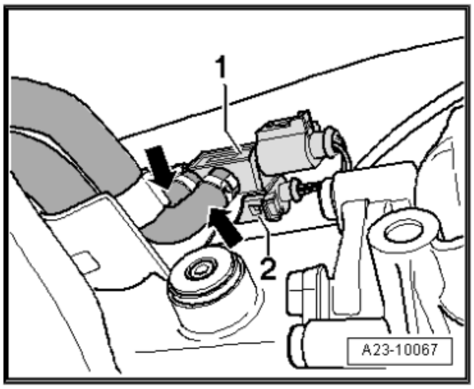
5.2 Removing and installing temperature sender before particulate filter -G506-

Removing

Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

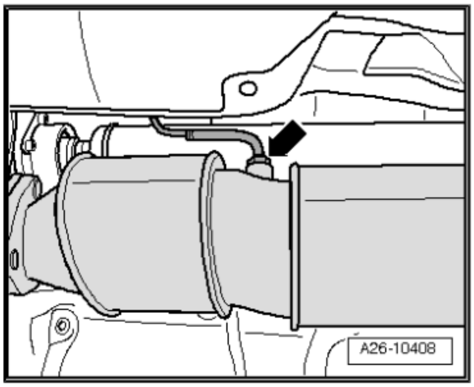
- Unplug electrical connector -2- at temperature sender before particulate filter -G506- .
- Fitting location: at rear of gearbox (right-side).



Note

Ignore items marked -1- and -arrows-.

– Unscrew temperature sender before particulate filter -G506- -arrow-.



Installing

Installation is carried out in the reverse order; note the following:

Note

- *Fit all cable ties in the original positions when installing.*
- *Fit all heat insulation sleeves in the original position when installing.*

Tightening torque

Component	Nm
Temperature sender before particulate filter -G506- to particulate filter	45 [1]
• [1] Coat thread with high-temperature paste; refer to ⇒ Parts catalogue .	

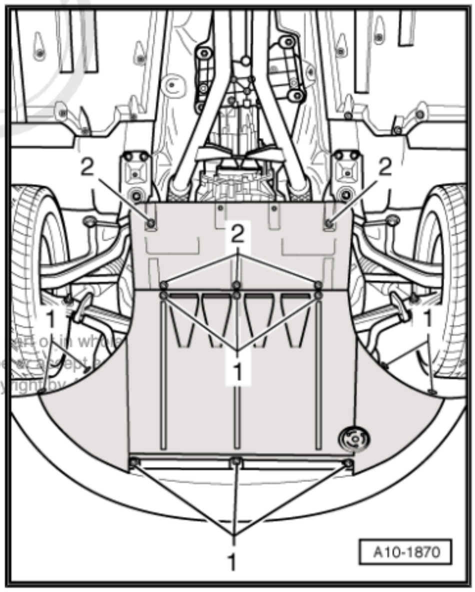
5.3 Removing and installing exhaust gas temperature sender 2 for bank 1 -G448-

Removing

Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Open quick-release fasteners -2- and remove rear noise insulation.

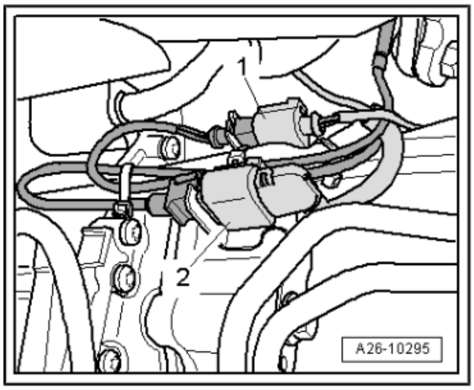


– Unplug electrical connector -1- at exhaust gas temperature sender 2 for bank 1 -G448- and move wiring clear.

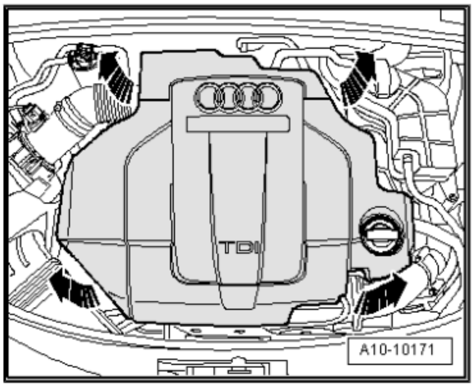
- Fitting location: at front of gearbox (left-side).

Note

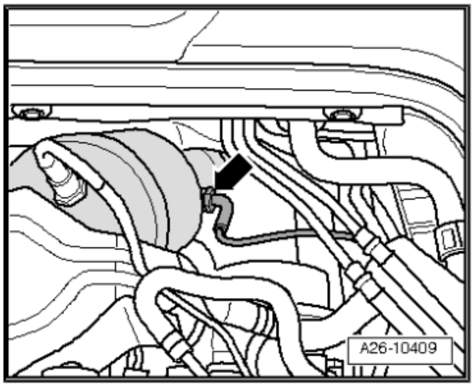
Disregard -item 2-.



– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Unscrew exhaust gas temperature sender 2 for bank 1 -G448- -arrow-.



Installing

Installation is carried out in the reverse order; note the following:

Note

◆ *Fit all cable ties in the original positions when installing.*

◆ *Fit all heat insulation sleeves in the original position when installing.*

Tightening torque

Component	Nm
Exhaust gas temperature sender 2 for bank 1 -G448- to particulate filter	45 [1]
• [1] Coat thread with high-temperature paste; refer to ⇒ Parts catalogue .	

6 Exhaust gas recirculation system and cooling for exhaust gas recirculation system

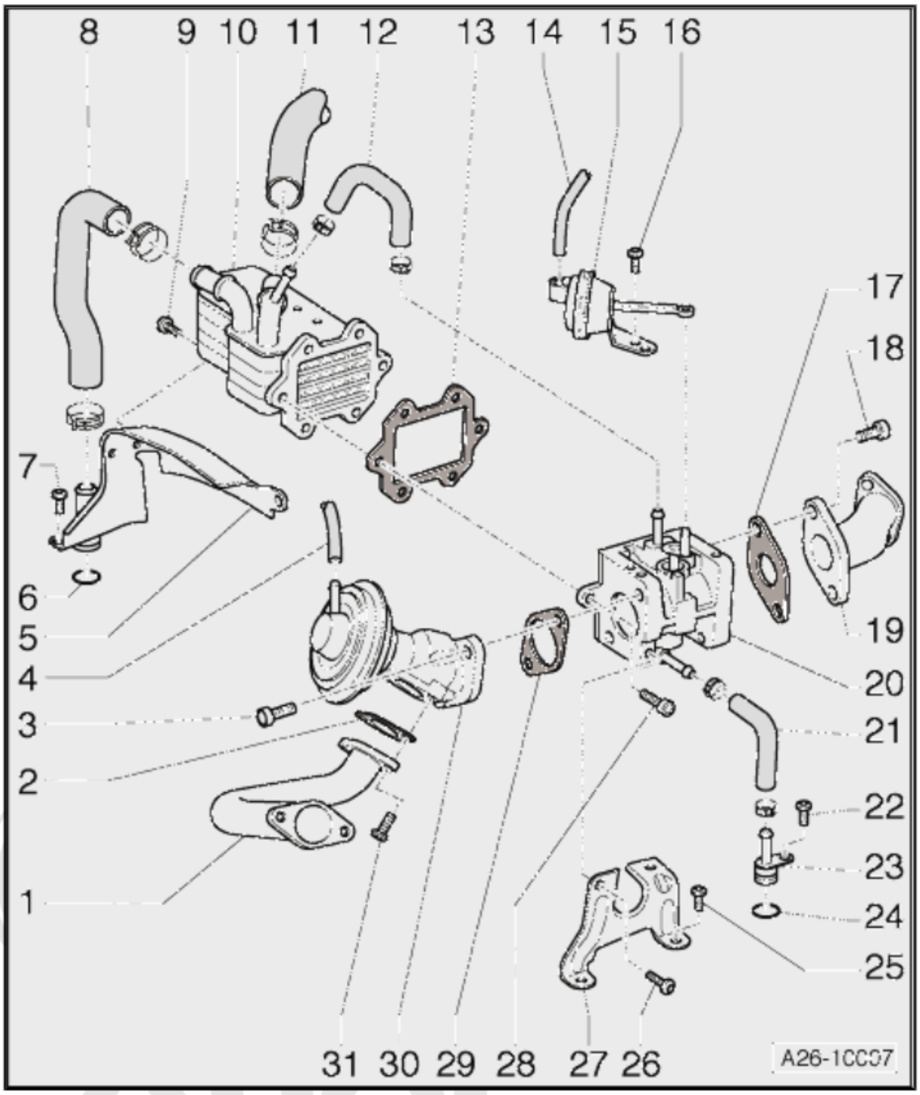
Exhaust gas recirculation system

- To improve exhaust emission values, exhaust gas is recirculated to the combustion chambers, thus reducing the combustion chamber temperature.
- The exhaust gas recirculation system is activated by the diesel direct injection system control unit -J248- via the exhaust gas recirculation valve -N18- and the mechanical exhaust gas recirculation valve.
- The tapered plunger in the mechanical exhaust gas recirculation valve varies the opening cross section according to valve travel.
- Pulsed actuation makes it possible to obtain any required valve position.
- The exhaust gas recirculation is switched off after approx. 2 minutes at idling speed.
- Restart engine or briefly increase engine speed above 1500 rpm when longer checks are necessary. Then repeat measurement.

Cooling for exhaust gas recirculation system

- To further improve the exhaust emission values, the exhaust gas recirculation system is equipped with a cooler that is connected into the engine cooling system.
- Under certain operating conditions, the flow of exhaust gas that is recirculated to the combustion chamber is routed via this cooler. The exhaust gas temperature is thereby reduced, further lowering the combustion temperature and improving the exhaust emission values.
- The engine control unit determines when the recirculated exhaust gas is routed via the cooler. The control unit actuates a vacuum unit via the exhaust gas recirculation cooler change-over valve -N345- , and the vacuum unit in turn operates the change-over flap for the exhaust gas recirculation cooler.

6.1 Exhaust gas recirculation system - exploded view



1 - Connecting pipe for exhaust gas recirculation

2 - Gasket
- ☐ Renew

3 - 25 Nm

4 - Vacuum hose
- ☐ From exhaust gas recirculation valve -N18-

5 - Bracket for exhaust gas recirculation cooler
- ☐ With connection for coolant hose

6 - O-ring
- ☐ Renew

7 - 9 Nm

8 - Coolant hose

9 - 9 Nm

10 - Exhaust gas recirculation cooler
- ☐ Removing and installing ⇒ page 301

11 - Coolant hose

12 - Coolant hose

13 - Gasket
- ☐ Renew

14 - Vacuum hose
- ☐ From exhaust gas recirculation cooler change-over valve -N345-

15 - Vacuum unit for exhaust gas recirculation cooler change-over

16 - 4 Nm

17 - Gasket
- ☐ Renew

18 - 25 Nm

19 - Connecting pipe for exhaust gas recirculation

20 - Change-over flap for exhaust gas recirculation cooler

21 - Coolant hose

22 - 9 Nm

23 - Connection for coolant hose

24 - O-ring
- ☐ Renew

25 - 9 Nm

26 - 9 Nm

27 - Bracket for change-over flap for exhaust gas recirculation cooler

28 - 9 Nm

29 - Gasket

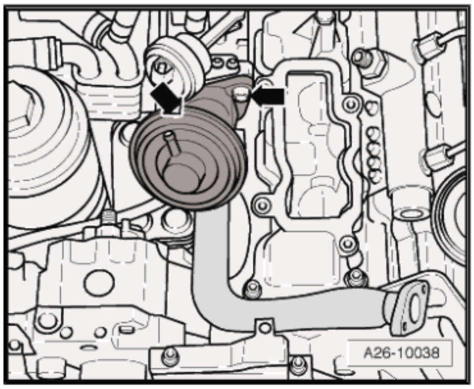
- ☐ Renew

30 - Mechanical exhaust gas recirculation valve

- ☐ Removing and installing ⇒ page 301

31 - 9 Nm

6.2 Removing and installing mechanical exhaust gas recirculation valve



Removing

- Remove intake manifold (top section) ⇒ Rep. gr. 23 .
- Remove bolts -arrows- and take off mechanical exhaust gas recirculation valve with connecting pipe.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seals and gaskets.

- Install intake manifold (top section) ⇒ Rep. gr. 23 .

Tightening torques

Component	Nm
Mechanical exhaust gas recirculation valve to connecting flange	22
Connecting pipe to mechanical exhaust gas recirculation valve	9

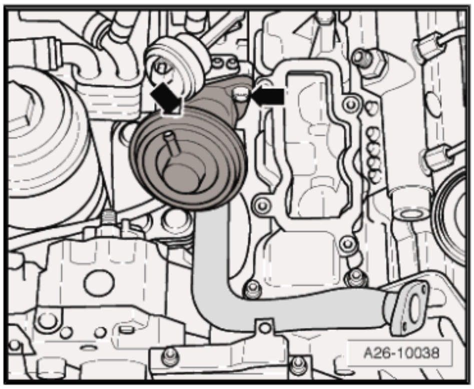
6.3 Removing and installing exhaust gas recirculation cooler

Removing

- Drain off coolant ⇒ page 202 .
- Remove intake manifold (top section) ⇒ Rep. gr. 23 .
- Remove bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .

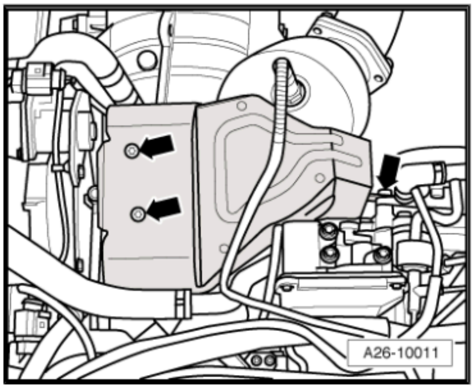
Vehicles up to 10.2004:

– Remove bolts -arrows- and take off mechanical exhaust gas recirculation valve with connecting pipe.

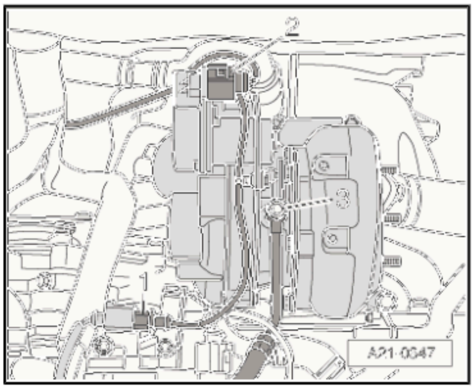


All vehicles:

– Remove heat shield for turbocharger -arrows-.



– Remove banjo bolt -3- and disconnect oil supply line from turbocharger.

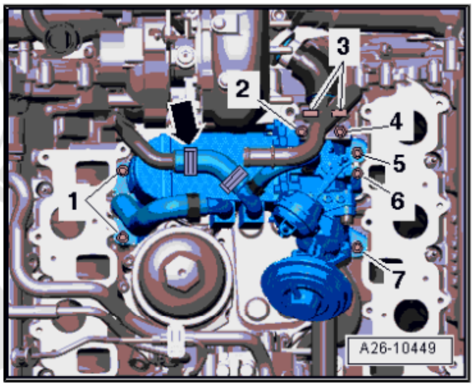


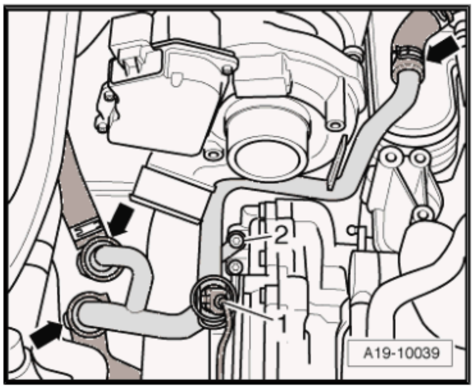
Note

Disregard items -1- and -2-.

– Detach hose -arrow-.

– Remove bolts -1 ... 7-.





– Remove bolt -2- and push coolant pipe (rear) slightly to the side.

Note

Ignore items marked -1- and -arrows-.

– Lift off cooler for exhaust gas recirculation from cylinder block.

Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets, seals and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

– Install mechanical exhaust gas recirculation valve ⇒ page 301 .

– Install bottom section of intake manifold (left and right) ⇒ Rep. gr. 23 .

– Install intake manifold (top section) ⇒ Rep. gr. 23 .

– Fill cooling system ⇒ page 204 .

Tightening torques

Component		Nm
Exhaust gas recirculation cooler to cylinder block		9
Connecting pipe to exhaust gas recirculation cooler		25
Coolant pipe (rear) to cylinder head		9
Crankcase breather pipe to change-over flap for exhaust gas recirculation cooler		9
Heat shield to:	Turbocharger	9
	Cylinder head	9

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00 – Technical data

1 Safety precautions

(ARL003638; Edition 12.2013)

⇒ “1.1 Safety precautions when working on the fuel system”, page 1

⇒ “1.2 Safety precautions when using testers and measuring instruments during a road test”, page 2

1.1 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:

WARNING

Risk of injury - fuel system operates under pressure.

- *Wrap a cloth around the connection before opening the fuel system. Then release pressure by carefully loosening the connection.*
- *Wear protective gloves.*
- *Wear safety goggles.*

The fuel can become extremely hot. This can cause injuries.

- *In extreme cases the temperature of the fuel lines and the fuel can be up to 100 °C after the engine is switched off. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- *Wear protective gloves.*
- *Wear safety goggles.*

Health risk: avoid skin contact with fuel.

- *Avoid skin contact with fuel. Wear fuel-resistant gloves.*

Perform the following steps before starting work on the fuel system:

- Fuel tank must not be full. The amount of fuel which can be left in the fuel tank is indicated in the corresponding procedure description. Drain fuel tank if necessary ⇒ page 7 .
- Before commencing work, switch on exhaust extraction system and place an extraction hose close to the opening in the fuel tank to extract escaping petrol fumes.
- If no exhaust extraction system is available, a radial fan with a displacement of at least 15 m^3/h can be used (the fan motor must be clear of the air stream).

WARNING

Risk of accident caused by weight of fuel tank

- *Fuel tank must be empty when installing and removing to reduce weight. Drain fuel tank if necessary ⇒ page 7 .*

Observe the following points to prevent personal injuries and damage to the injection and glow plug system:

- Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as injectors and gas-discharge headlights.
- Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.
- Do not open any fuel line connections while the engine is running.
- Always switch off ignition before washing engine.
- When installing, note colour coding of plug-in connectors.
- Plug-in connectors should engage audibly when connecting.
- Pull plug-in connectors to check that they are correctly engaged.
- Erase any entries in event memory resulting from testing or installation ⇒ Vehicle diagnostic tester, `Guided Functions`, then `Interrogate event memory`.

Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- *Observe notes on procedure for disconnecting the battery.*
- *Always switch off the ignition before disconnecting the battery ⇒ Electrical system; Rep. gr. 27 .*

1.2 Safety precautions when using testers and measuring instruments during a road test

Note the following if testers and measuring instruments have to be used during a road test:

WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

2 Repair instructions

⇒ “2.1 Rules for cleanliness”, page 3

⇒ “2.2 Test conditions”, page 3

⇒ “2.3 Contact corrosion”, page 3

⇒ “2.4 Routing and attachment of pipes, hoses and wiring”, page 4

2.1 Rules for cleanliness

Even small amounts of dirt can cause malfunctions. When working on the fuel supply system and injection system, pay careful attention to the following basic rules:

- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- Immediately seal open lines and connections with clean plugs, for example from engine bung set - VAS 6122- .
- Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- When the system is open, do not work with compressed air and do not move the vehicle.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.
- Make sure that no diesel fuel comes into contact with other components in the engine compartment. If necessary, clean immediately.

2.2 Test conditions

- Battery in standby mode ("Stützbetrieb") ⇒ Electrical system; Rep. gr. 27 .
- Fuses for fuel pump/ fuel pump relay - J17- / fuel pump control unit - J538- OK ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Fuel pump relay - J17- OK ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Fuel pump control unit - J538- OK; checking in `Guided Fault Finding` ⇒ Vehicle diagnostic tester.
- Fuel tank at least $^{1}/_{4}$ full.
- Fuel filter OK.
- Fuel lines OK (not obstructed or crushed).
- Ignition off.

2.3 Contact corrosion

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).

For this reason, only fasteners with a special surface coating are used.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Electronic parts catalogue .

Note the following:

- We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- We recommend the use of Audi accessories.
- Damage caused by contact corrosion is not covered under warranty.

2.4 Routing and attachment of pipes, hoses and wiring

Caution

Risk of damage to pipes/hoses/wiring.

- *The original routing must be restored when installing any kind of pipes/hoses/wiring.*
- *Due to the restricted space in the engine compartment, it is important to ensure sufficient clearance from all moving or hot components.*

20 – Fuel supply system

1 Fuel supply system

⇒ “1.1 Fuel tank with components - exploded view”, page 5

⇒ “1.2 Draining fuel tank”, page 7

⇒ “1.3 Removing and installing fuel tank with attached components”, page 10

⇒ “1.4 Routing of pipes/hoses (inside fuel tank) - overview”, page 16

⇒ “1.5 Fuel delivery unit (left-side) with fuel system pressurisation pump G6 ; fuel gauge sender G and fuel gauge sender 3 G237 - exploded view of components”, page 17

⇒ “1.6 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump G6 ”, page 18

⇒ “1.7 Fuel delivery unit (right-side) with fuel pump G23 ; fuel gauge sender 2 G169 and fuel gauge sender 4 G393 - exploded view of components”, page 27

⇒ “1.8 Removing and installing fuel delivery unit (right-side) with fuel pump G23 ”, page 29

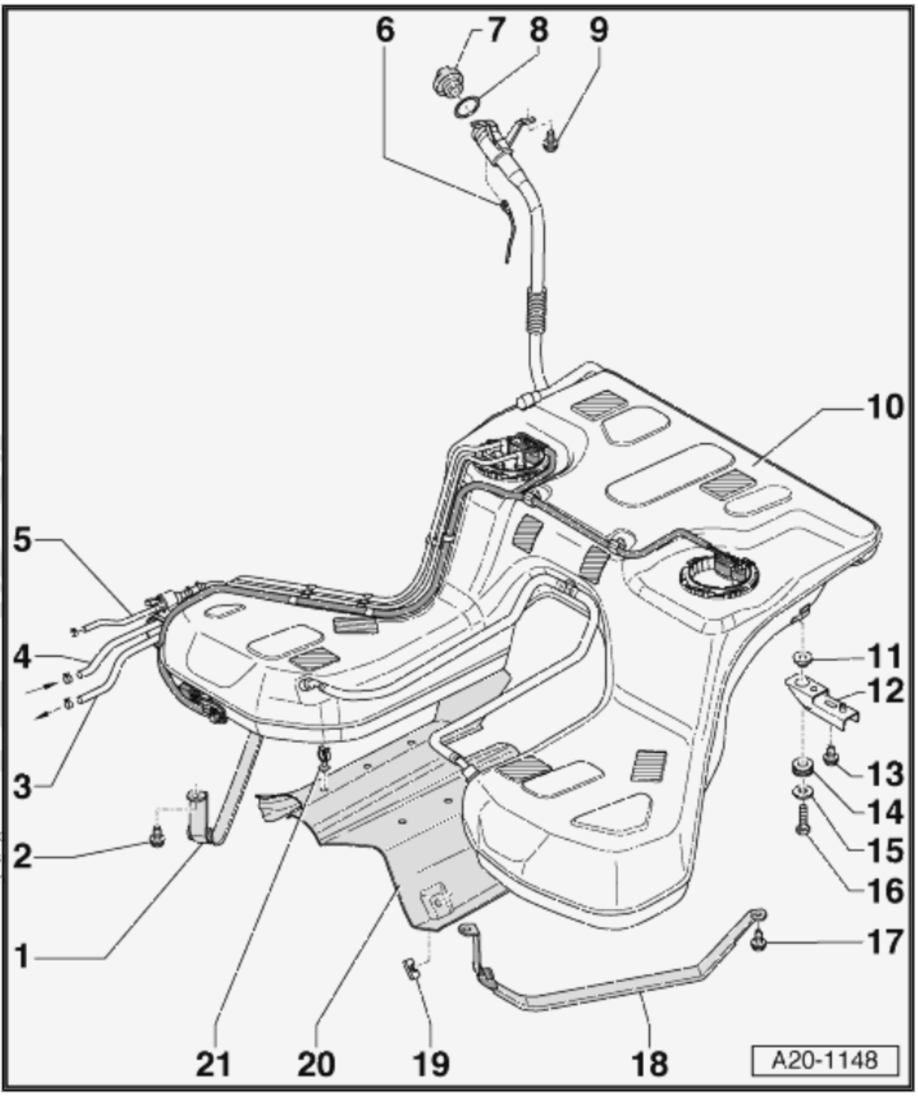
⇒ “1.9 Checking fuel pump delivery rate”, page 38

⇒ “1.10 Suction-jet pumps: operation”, page 40

⇒ “1.11 Removing and installing suction-jet pump (left-side)”, page 41

⇒ “1.12 Removing and installing suction-jet pump (right-side)”, page 43

1.1 Fuel tank with components - exploded view



1 - Securing strap
- ☐ With spacer, installation position ⇒ page 7

2 - 22 Nm

3 - Fuel supply line
- ☐ To fuel filter
- ☐ Mark before removing
- ☐ Clip onto fuel tank

4 - Fuel return line
- ☐ From fuel cooler
- ☐ Mark before removing
- ☐ Clip onto fuel tank

5 - Supply line
- ☐ To auxiliary heater

6 - Earth connection
- ☐ To eliminate electrostatic charge
- ☐ Installation position / test procedure ⇒ page 7
- ☐ Make sure that connector is securely fitted
- ☐ After installation, use an ohmmeter to check the electrical connection between the fuel filler neck and a bare metal part on the body. Specification: approx. 0 Ω

7 - Filler cap

8 - Seal
- ☐ Renew if damaged

9 - 22 Nm

10 - Fuel tank
- ☐ Removing and installing ⇒ page 10

11 - Bush

12 - Fuel tank bracket

13 - 22 Nm

14 - Rubber buffer

15 - Washer

16 - 22 Nm

17 - 22 Nm

18 - Securing strap
- ☐ With spacer, installation position ⇒ page 7

19 - Retaining clip for heat shield

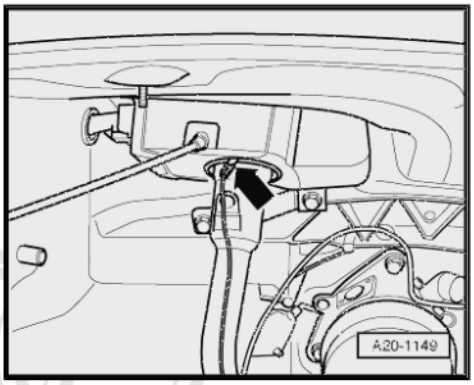
20 - Heat shield

21 - Retaining clip for heat shield

Installation position of earth connection

– Route earth connection as shown in illustration.

– Ensure that connector for earth connection is securely fitted on metal ring on fuel filler neck -arrow-.



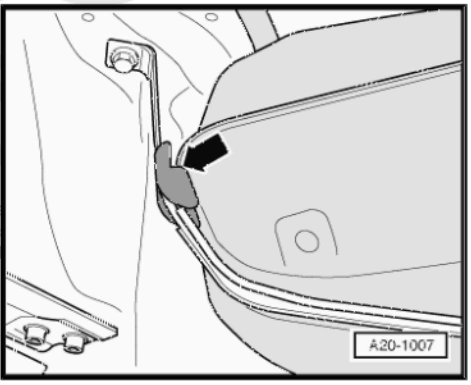
Caution

After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:

- *Specification: approx. 0 Ω.*

Installation position of spacers

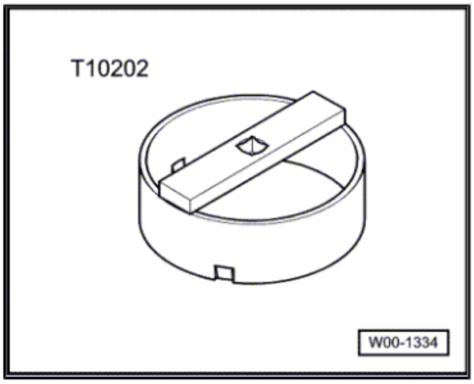
– Make sure that the securing strap spacers are located directly under seam of fuel tank -arrow-.



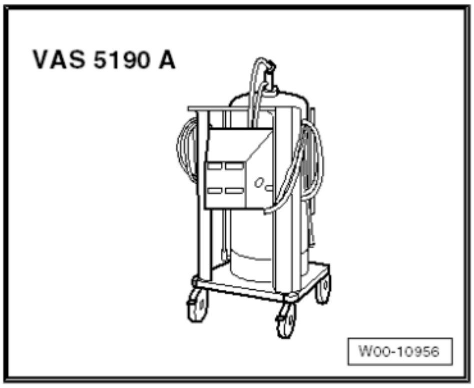
1.2 Draining fuel tank

Special tools and workshop equipment required

- ♦ Wrench - T10202-



- ♦ Fuel extractor - VAS 5190A-



Procedure

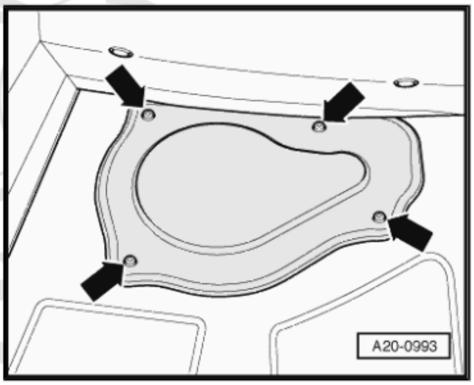
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

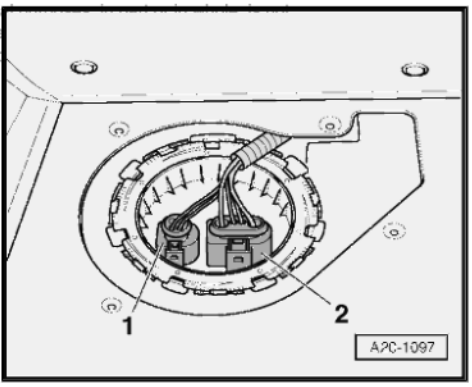
WARNING

Switch off ignition and remove ignition key to stop ignition being switched on inadvertently whilst working.

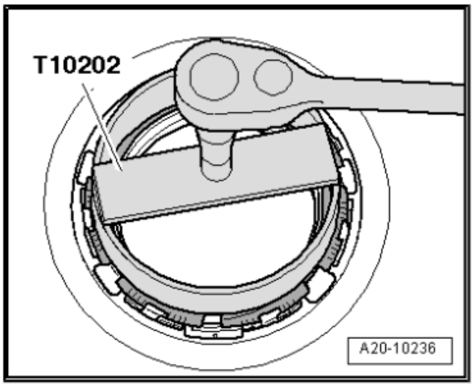
- Remove luggage compartment floor lining.
- Detach cover for flange (left-side) -arrows-.



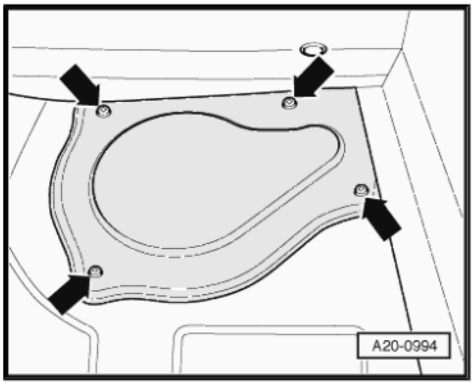
- Unplug electrical connectors -1- and -2- at flange.



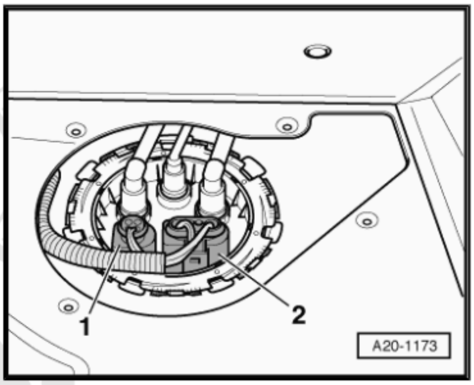
- Unscrew locking ring using wrench - T10202- .



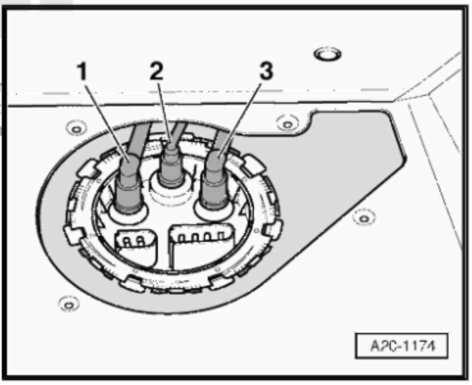
- Unscrew cover for flange (right-side) -arrows-.



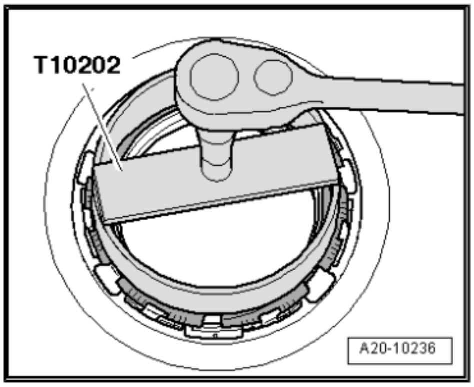
- Unplug electrical connectors -1- and -2- at flange.



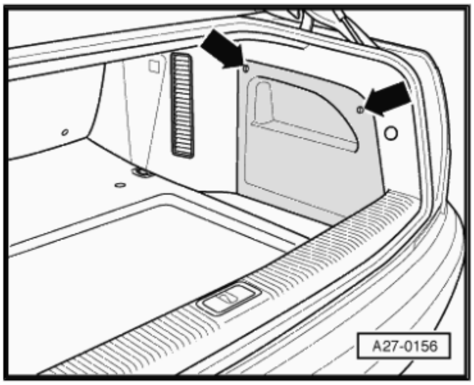
- Mark fuel return line -1- and fuel supply line -3-.
- Detach both lines from flange (press release tabs).
- In addition, disconnect fuel line -2- leading to metering pump for auxiliary heater (press release tab).



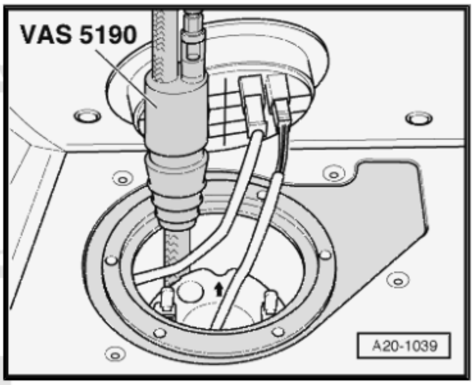
- Unscrew locking ring using wrench - T10202- .



- Remove luggage compartment side trim cover (right-side) -arrows-.
- Connect earth wire of fuel extractor -VAS 5190A- to earth stud of energy management control unit - J644- .

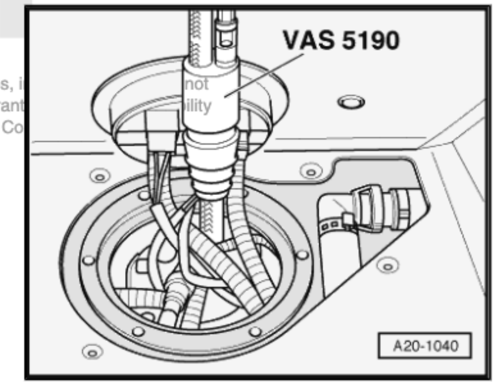


- Remove flange (left-side) and lay it aside with electrical wires connected.
- Remove seal.
- Extract fuel from left fuel tank chamber through fuel tank opening using fuel extractor - VAS 5190A- .



- Remove flange (right-side) and lay it aside with electrical wires and fuel lines connected.
- Remove seal.

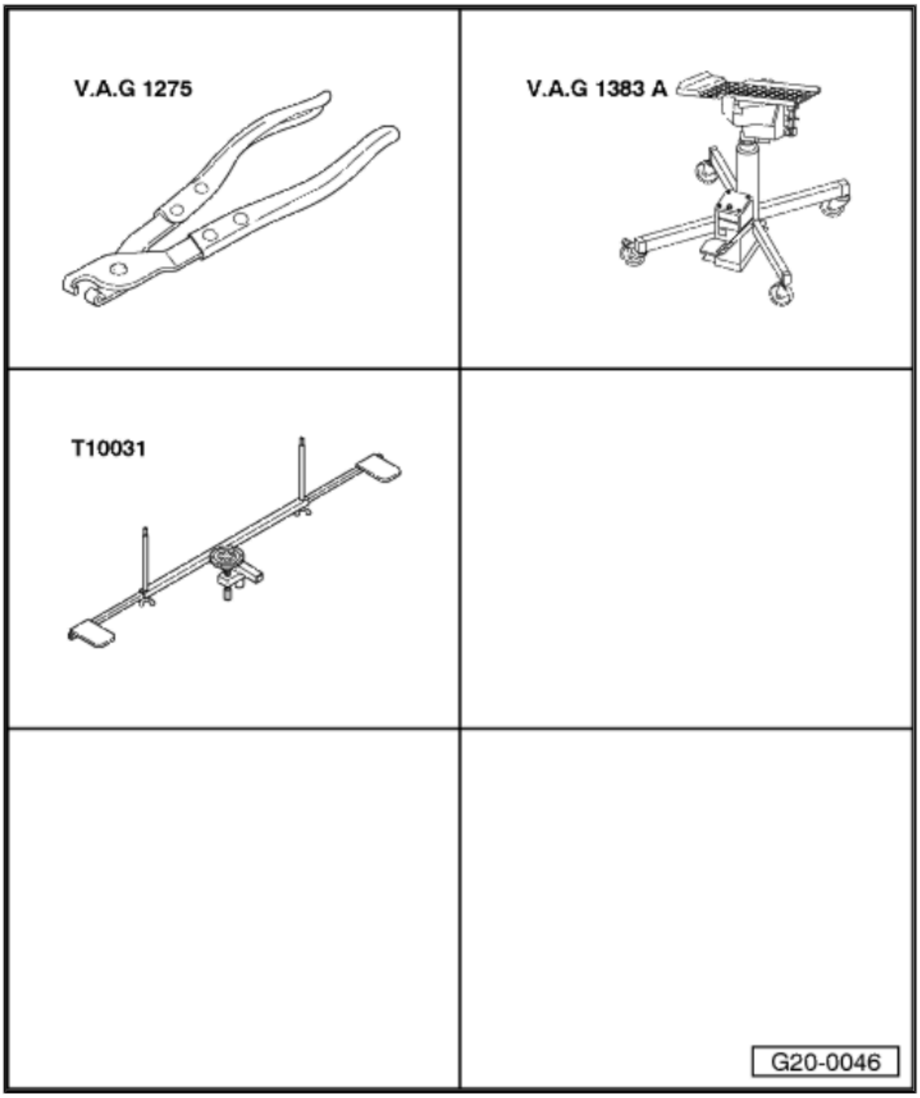
- Extract fuel from right fuel tank chamber through fuel tank opening using fuel extractor unit - VAS 5190A- .
- Re-install flange: left-side ⇒ page 53 , right-side ⇒ page 59 .



1.3 Removing and installing fuel tank with attached components

Special tools and workshop equipment required

- Hose clip pliers - V.A.G 1275-
- Engine and gearbox jack - V.A.G 1383 A-
- Support - T10031-



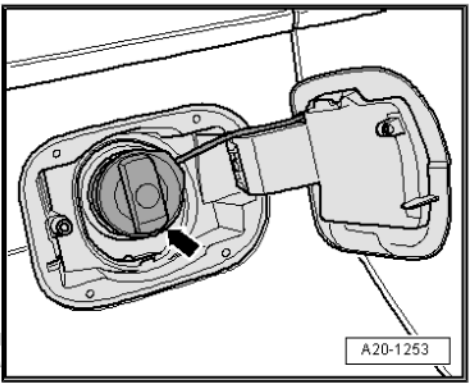
Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

- To reduce weight, the fuel tank must be empty when it is removed from the vehicle. Drain the tank if necessary. Procedure ⇒ page 7

- Release the tank flap.
- Clean area around fuel filler neck.
- Remove filler cap -arrow- from fuel filler neck.
- Seal opening of fuel filler neck with a piece of clean foam or similar to prevent dirt from dropping into the tank.
- Remove rear right wheel housing liner ⇒ Rep. gr. 66 .

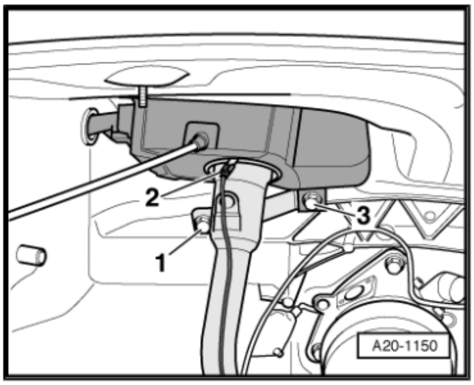


WARNING

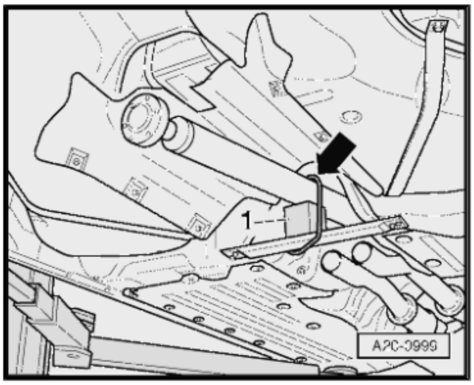
BEFORE loosening subframe bolts, take steps to ensure that vehicle does not tip forwards (e.g. put a weight of about 50 kg in luggage compartment).

- Remove rear axle ⇒ Rep. gr. 42 .

- Disconnect earth wire -2- from fuel filler neck.
- Remove bolts -1- and -3- for fuel filler neck.



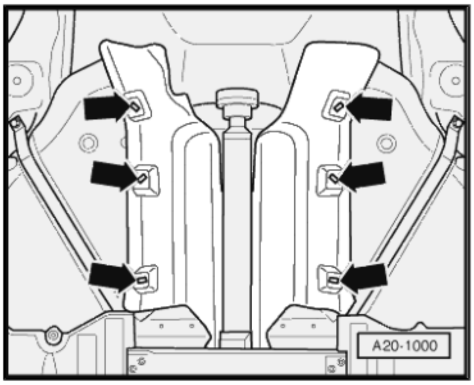
- Check that propshaft is secured to prevent it falling.
- The propshaft should be placed on a block of wood -1- and secured with wire or a cable tie -arrow-.
- The propshaft should be inclined slightly downwards to ensure there is sufficient space when installing the fuel tank.



Note

The propshaft must not be bent more than 8°.

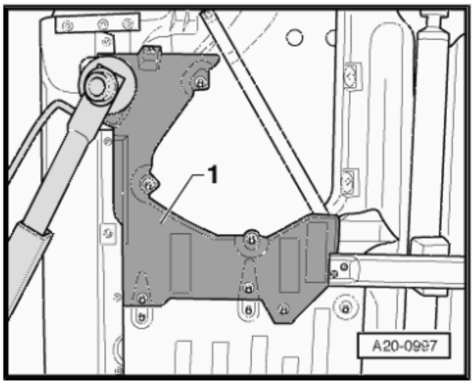
- Remove heat shield for propshaft -arrows-.



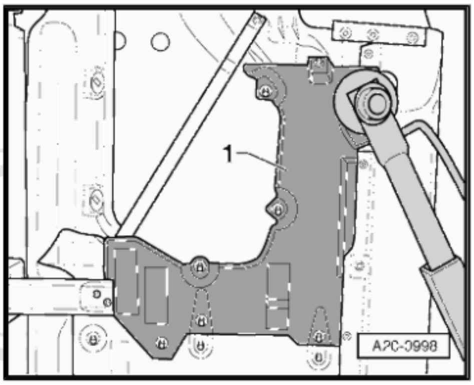
Note

The heat shield is also clipped in at the top of the breather pipe.

– Remove cover -1- from underside of vehicle (left-side).



– Remove cover -1- from underside of vehicle (right-side).



– Unplug electrical connectors:

1 - To metering pump for auxiliary/additional heater

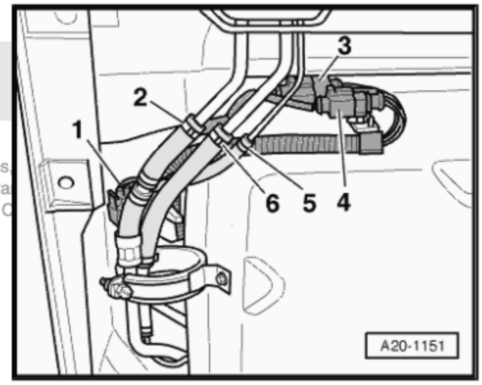
3 - To fuel pumps

4 - To fuel gauge senders

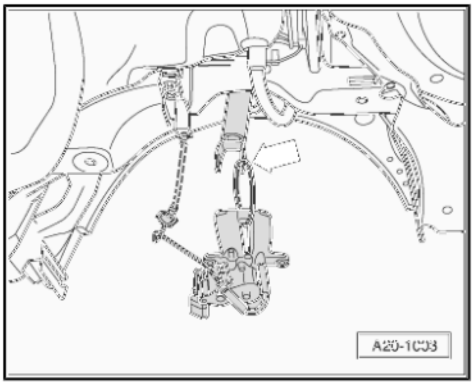
– Mark fuel supply line -2- and fuel return line -6-.

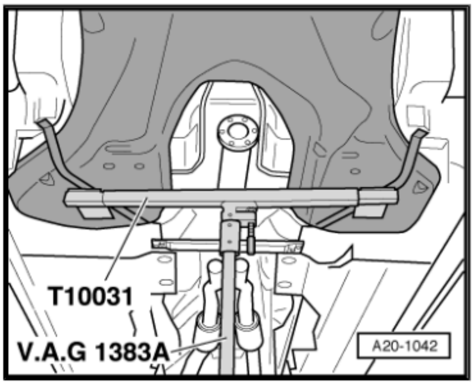
– Remove hose clips (with lug fasteners) and disconnect both fuel lines.

– Also disconnect fuel line -5- leading to metering pump for auxiliary heater by removing hose clip (with lug fastener).



– Attach brake calipers to suspension struts with wire -arrow- (brake calipers were fastened to fuel tank brackets upon removal of rear suspension).

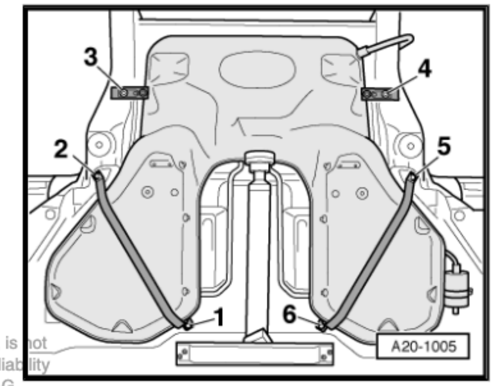




- Position engine and gearbox jack - V.A.G 1383 A- with support - T10031- under vehicle to support tank (do not use threaded rods of support).
- Support fuel tank using engine and gearbox jack - V.A.G 1383 A- and support - T10031- .
- In addition, a 2nd mechanic will be required to support the fuel tank at the rear by hand.

WARNING

To reduce weight, fuel tank must be empty upon removal.



- Unscrew bolts -1 ... 6-; swivel fuel tank brackets forward if necessary.
- First lower fuel tank slightly at the rear so the fuel filler neck can be guided out of the body.
- Then lower fuel tank using engine and gearbox jack - V.A.G 1383 A- , simultaneously guiding fuel tank down by hand.

Note

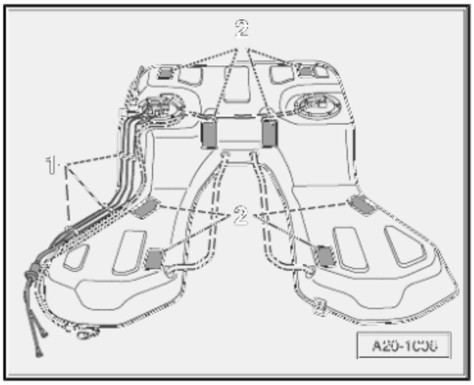
Illustration shows fuel tank without engine and gearbox jack - V.A.G 1383 A- .

Installing

Installation is carried out in the reverse order; note the following:

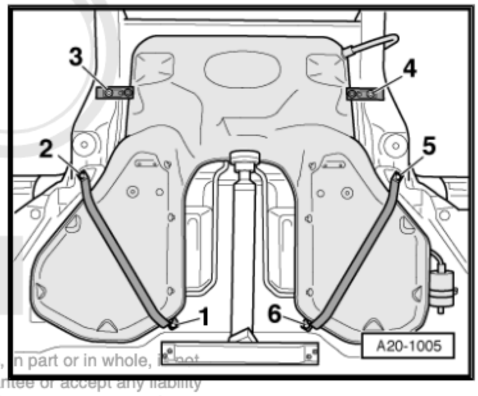
Note

- *Always renew seals and gaskets when assembling.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

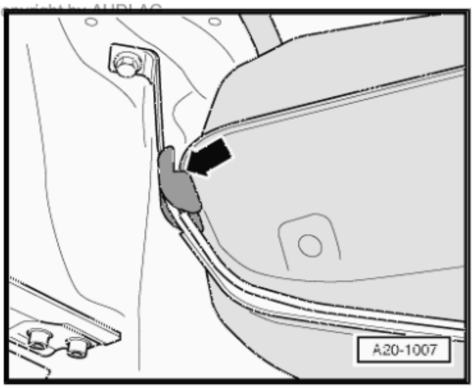


- Check that fuel pipes and wiring harness for fuel pumps and fuel gauge senders are clipped into brackets -1- on fuel tank.
- Bond pads -2- to fuel tank as shown when installing new fuel tank.

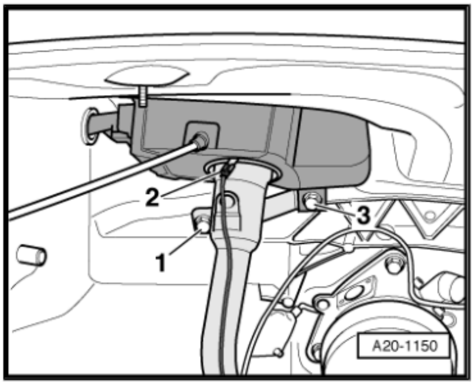
- Position the fuel tank with securing straps and brackets on underbody, using the engine and gearbox jack - V.A.G 1383 A- and support - T10031- .
- When installing fuel tank, make sure that the fuel filler neck is correctly inserted into the opening on the body.
- Secure fuel tank by first tightening bolts at points -1-, -2-, -5- and -6-, then at points -3- and -4-.



- Make sure that the securing strap spacers are located directly under seam of fuel tank -arrow-.

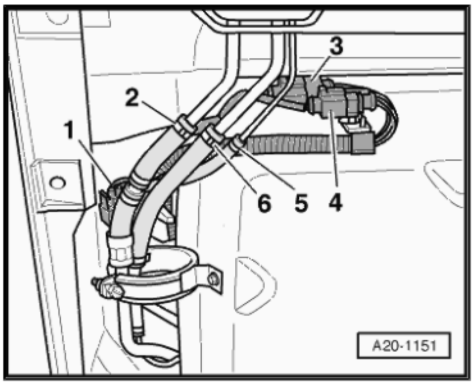


- Secure fuel filler neck using bolts -1- and -3-.
- Check the earth wiring -2- and connector tab for traces of oxidation. Remove any traces of oxidation if necessary.



> Caution
>
> *After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:*
>
> - *Specification: approx. 0 Ω.*

- Secure fuel pipes -2-, -5- and -6- using new hose clips (with lug fasteners). Use hose clip pliers - V.A.G 1275- for this purpose.
- Install rear axle ⇒ Rep. gr. 42 .
- Install rear right wheel housing liner ⇒ Rep. gr. 66 .
- Install rear section of exhaust system ⇒ Rep. gr. 26 .



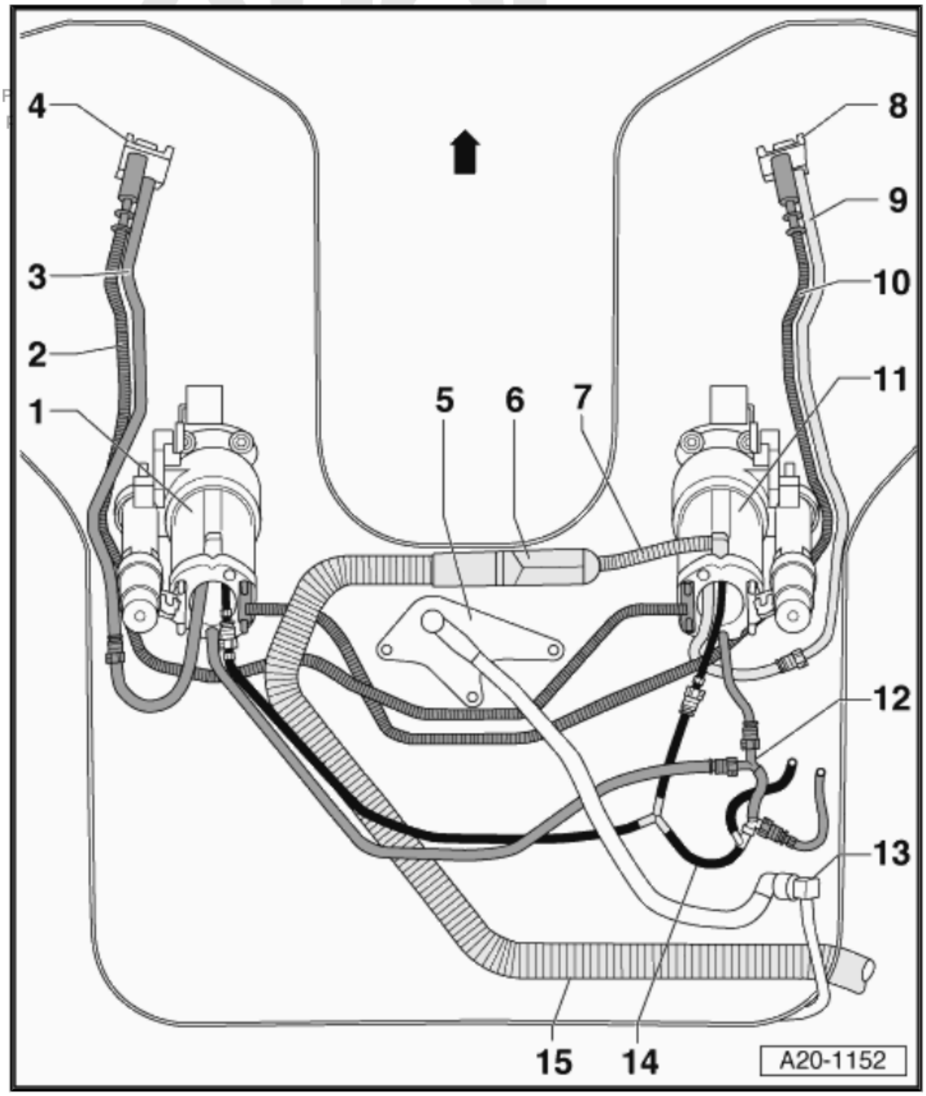
Tightening torques

Component	Nm
Securing straps and bracket for fuel tank to body	22
Fuel filler neck to wheel housing	22

1.4 Routing of pipes/hoses (inside fuel tank) - overview

Note

- *The illustration shows the correct routing of pipes/hoses inside the fuel tank (schematic view).*
- *It is not necessary to route the pipes/hoses in exactly the same way as shown in the illustration, except for pipes/hoses shown in ⇒ page 17 . However it is essential to fit the pipes/hoses with sufficient space in relation to each other and to prevent rattling noises.*
- *The -arrow- points in direction of travel.*



1 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

2 - Fuel supply line
  - ❑ From suction-jet pump (left-side) to fuel delivery unit (right-side)

3 - Supply line for suction-jet pump
  - ❑ From fuel pump (left-side) to suction-jet pump (left-side)

4 - Suction-jet pump (left-side)

5 - Gravity valve

6 - Non-return flap
  - ❑ For fuel filler pipe

7 - Primary filling fuel line
  - ❑ To fuel delivery unit (right-side).
  - ❑ Ensures that a small amount of fuel is delivered immediately to the fuel delivery unit when the tank is filled for the first time.

8 - Suction-jet pump (right-side)

9 - Supply line for suction-jet pump
  - ❑ From fuel pump (right-side) to suction-jet pump (right-side)

10 - Fuel supply line
  - ❑ From suction-jet pump (right-side) to fuel delivery unit (left-side)

11 - Fuel delivery unit (right-side) with fuel pump - G23-

12 - Fuel return line
  - ❑ From flange to fuel delivery units (left and right)

13 - Breather line
  - ❑ From gravity valve
  - ❑ Open to atmosphere at outside of fuel tank

14 - Fuel supply line

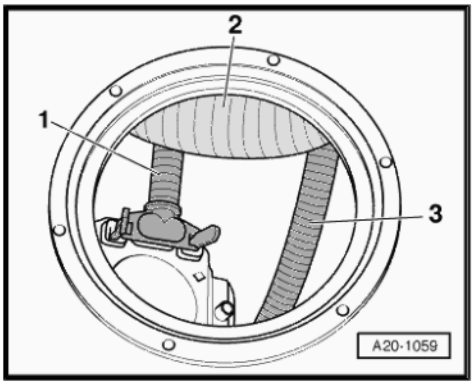
- ❑ From fuel pumps (left and right) to flange

15 - Fuel filler pipe

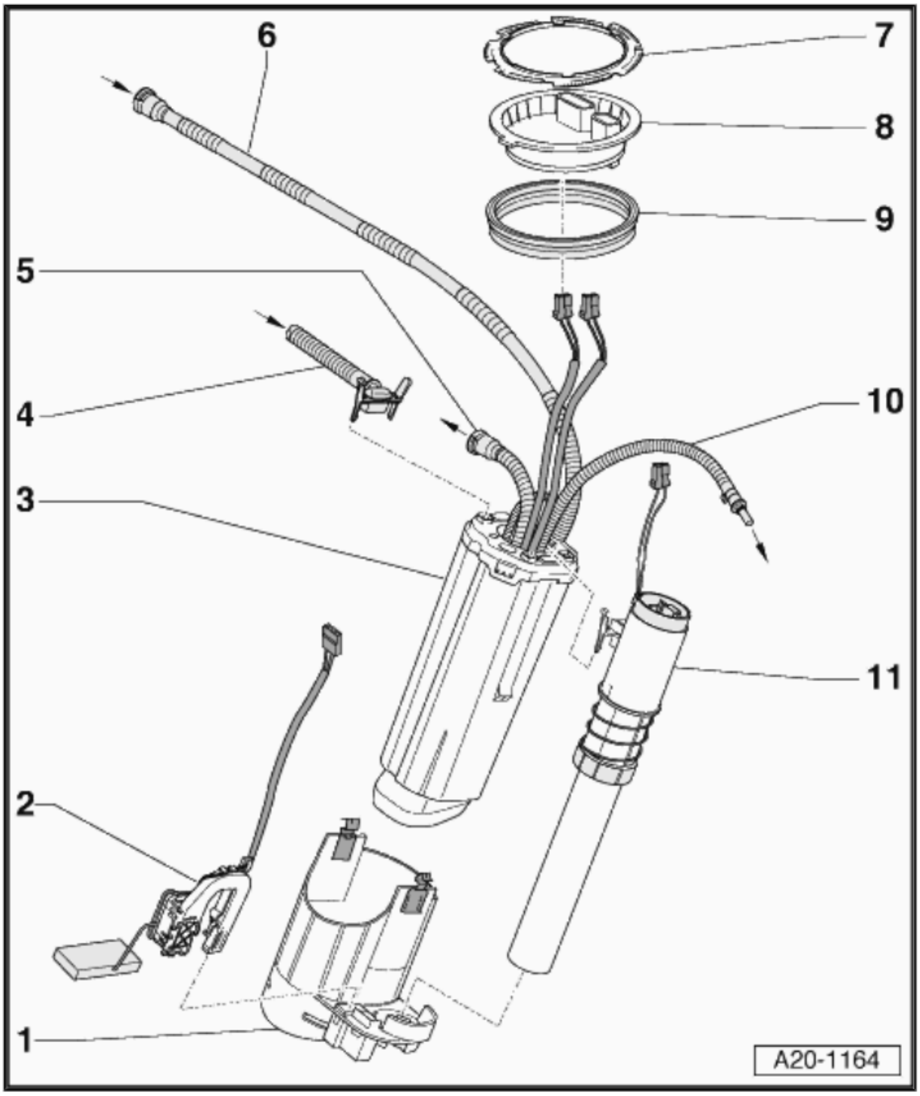
- ❑ From fuel filler neck to non-return flap in fuel tank

Installation position of fuel supply lines

The supply lines -1- and -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



1.5 Fuel delivery unit (left-side) with fuel system pressurisation pump - G6- ; fuel gauge sender - G- and fuel gauge sender 3 - G237- - exploded view of components



1 - Retainer

- ❑ For fuel delivery unit

2 - Fuel gauge sender - G-

- ❑ Black
- ❑ Clipped onto retainer ⇒ Item 1 (page 17)
- ❑ Checking resistance values ⇒ page 45
- ❑ Removing and installing ⇒ page 46

3 - Fuel delivery unit (left-side)

- ❑ With fuel system pressurisation pump - G6-
- ❑ Clipped onto retainer ⇒ Item 1 (page 17)
- ❑ Different versions are available; allocation ⇒ Parts catalogue
- ❑ Removing and installing ⇒ page 18
- ❑ Put at least 5 litres of fuel into tank after installing

4 - Fuel supply line

- ❑ From suction jet pump (right-side)
- ❑ Clipped onto fuel delivery unit ⇒ Item 3 (page 17)

5 - Fuel supply line

- ❑ Press release tab on connection piece to disconnect

6 - Fuel return line

- ☐ The plug connector is located on the right side of the fuel tank
- ☐ Press release tab on connection piece to disconnect

7 - Locking ring

- ☐ Remove and install using wrench - T10202-
- ☐ Tighten to 120 Nm

8 - Flange (left-side)

- ☐ Installation position ⇒ page 18

9 - Seal

- ☐ Renew
- ☐ Install dry

10 - Supply line for suction-jet pump

- ☐ For suction-jet pump (left-side)
- ☐ Press release tab on connection piece to disconnect

11 - Fuel gauge sender 3 - G237-

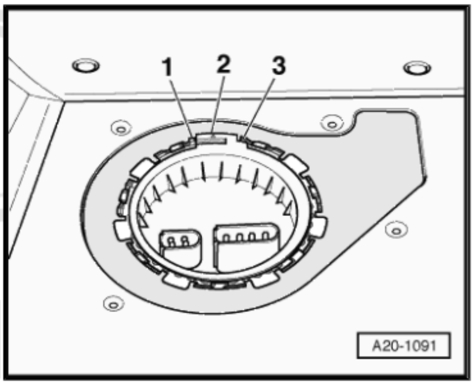
- ☐ Grey
- ☐ Clipped onto fuel delivery unit ⇒ Item 3 (page 17)
- ☐ Checking resistance values ⇒ page 49
- ☐ Removing and installing ⇒ page 50

Installation position of flange (left-side)

– Fit new seal for flange in fuel tank opening (seal should be dry).

– Fit flange into fuel tank; note correct installation position:

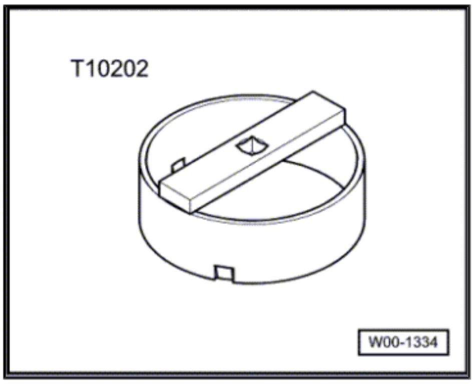
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



1.6 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

Special tools and workshop equipment required

- ♦ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

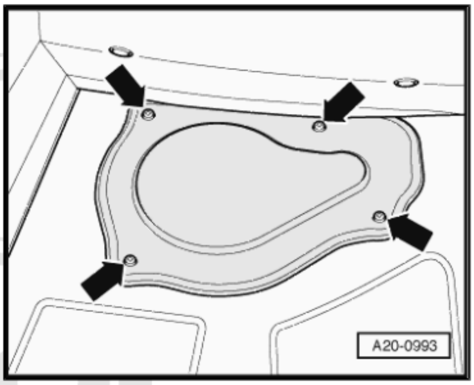
- The fuel tank must not be more than $^1/_3$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 7

Note

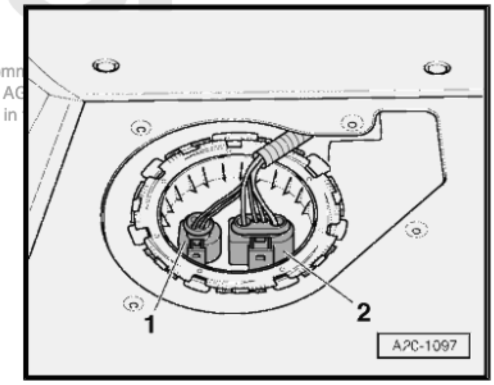
For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Remove luggage compartment floor lining.

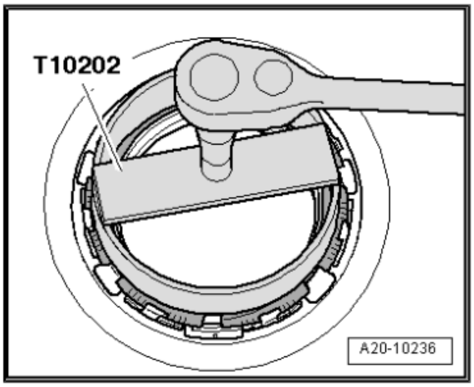
– Detach cover for flange (left-side) -arrows-.



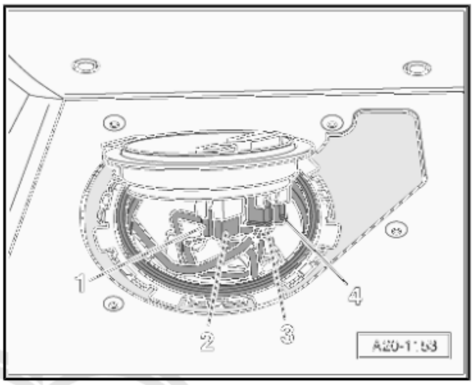
– Unplug electrical connectors -1- and -2- at flange.



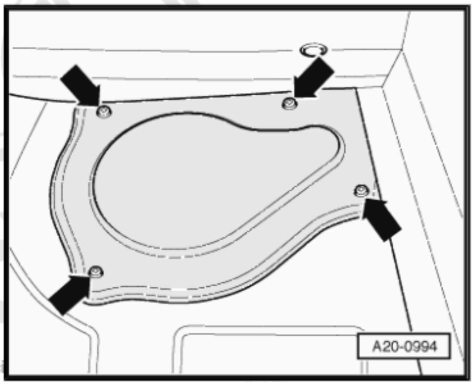
– Unscrew locking ring using wrench - T10202- .



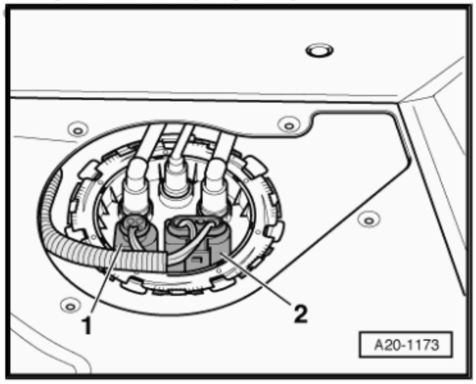
- Detach flange and remove seal.
- Detach electrical connectors -1 ... 4- at underside of flange.



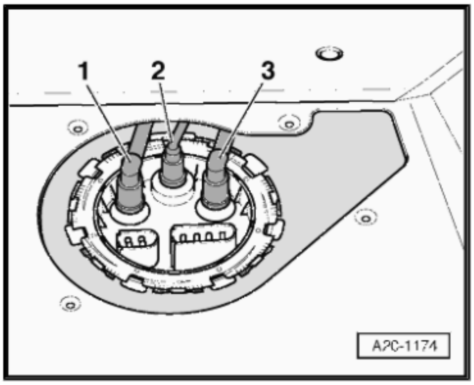
- Unscrew cover for flange (right-side) -arrows-.



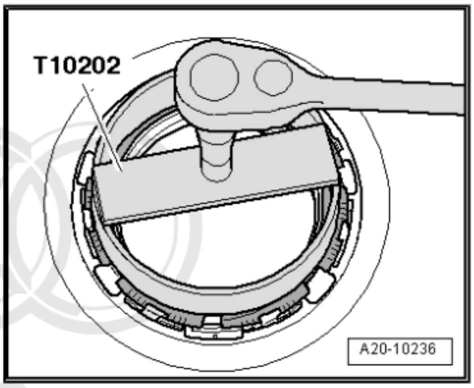
- Unplug electrical connectors -1- and -2- at flange.



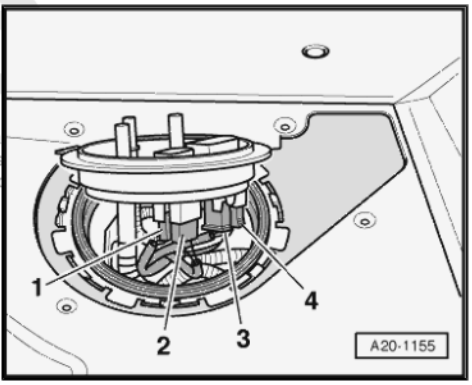
- Mark fuel return line -1- and fuel supply line -3-.
- Detach both lines from flange (press release tabs).
- In addition, disconnect fuel line -2- leading to metering pump for auxiliary heater (press release tab).



- Unscrew locking ring using wrench - T10202- .



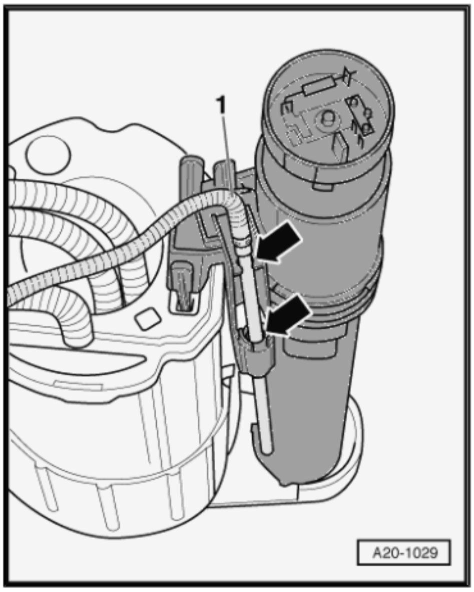
- Detach flange and remove seal.
- Detach electrical connectors -1 ... 4- at underside of flange.



Note

- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *Some of the components are shown removed in the following illustration.*

- Pull out suction pipe -1- for auxiliary heater from retainer -arrows- on tubular sender (right-side).

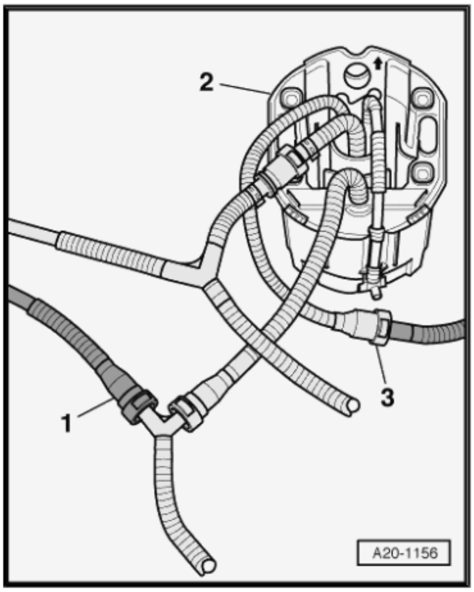


- Working through right fuel tank opening, press release tab and disconnect fuel line -1- going to fuel delivery unit (left-side).
- Pull disconnected fuel line out of left fuel tank opening.

2 - Fuel delivery unit (right-side) with fuel pump - G23- .

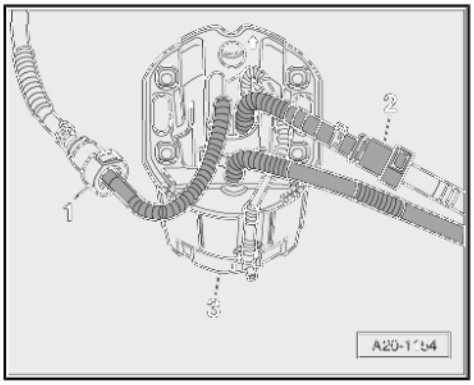
Note

Disregard -item 3-.

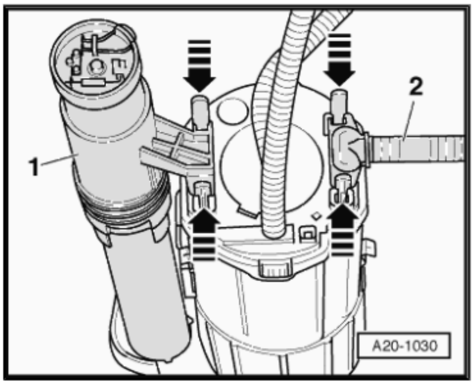


- Working through left fuel tank opening, press release tab and disconnect fuel line -1- going to suction-jet pump (left-side).
- Disconnect fuel line -2- going to fuel delivery unit (right-side) by pressing release tab.

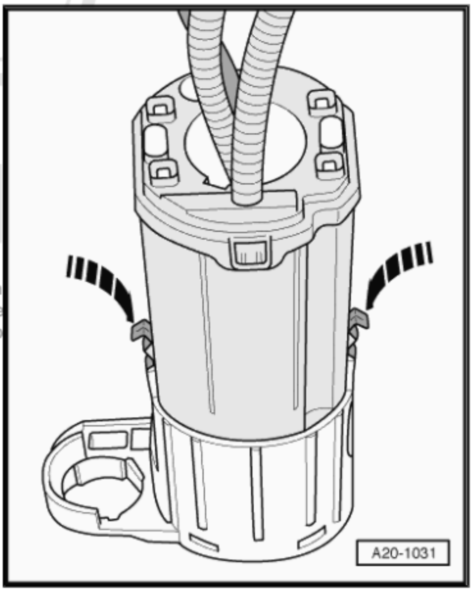
3 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6- .



- Working through left fuel tank opening, press release tabs -arrows- and detach supply line -2- and fuel gauge sender 3 - G237- -item 1-.
- Move fuel gauge sender 3 - G237- to left side.



- Press down both retaining clips on retainer for fuel delivery unit (left-side) -arrows-.
- Remove fuel delivery unit.

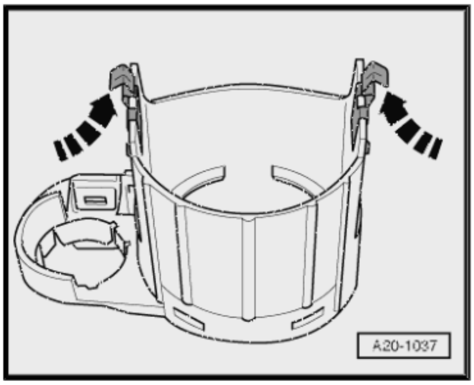


Note

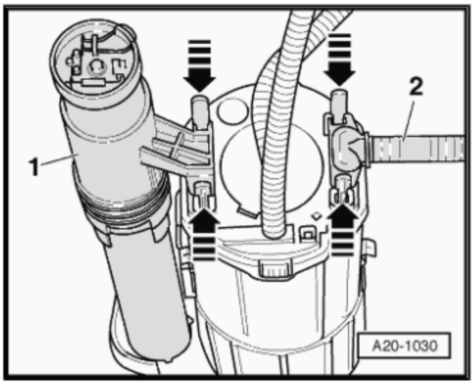
Keep in mind that the fuel delivery unit still contains fuel.

Installing

- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit (left-side).
- Then press fuel delivery unit carefully into retainer so that it engages audibly.

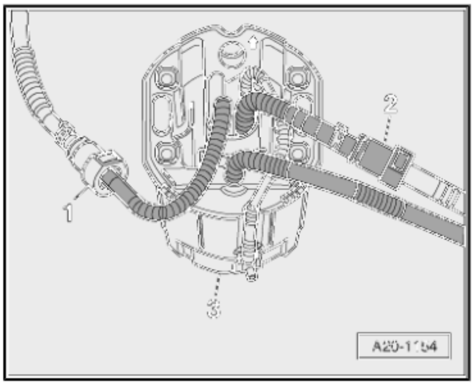


- Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.



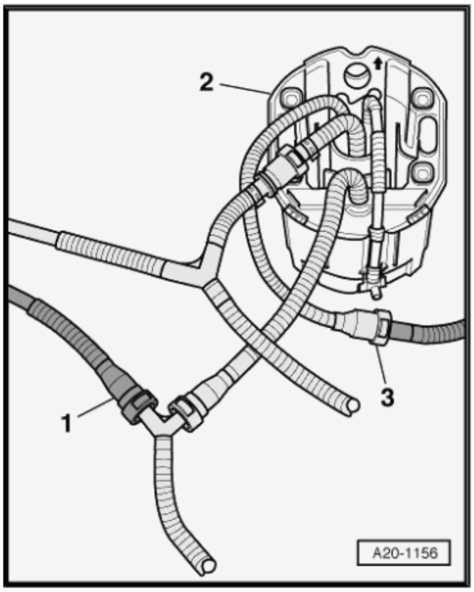
- Fit fuel lines -1- and -2- through left fuel tank opening so that they engage audibly.
- Guide return line for fuel delivery unit (left-side) into fuel tank chamber (right-side).

3 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6- .

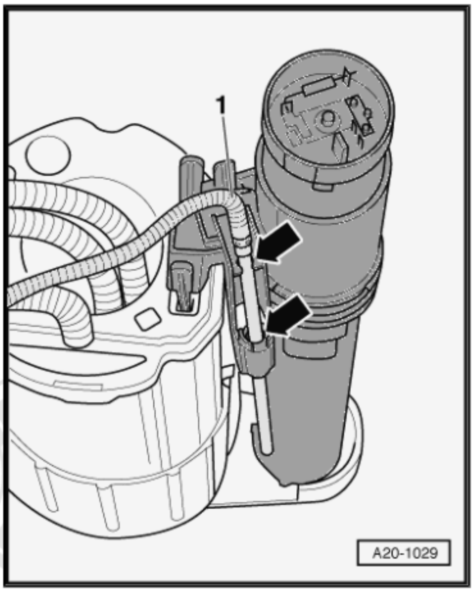


- Working through right fuel tank opening, fit fuel line -1- so that it engages audibly.

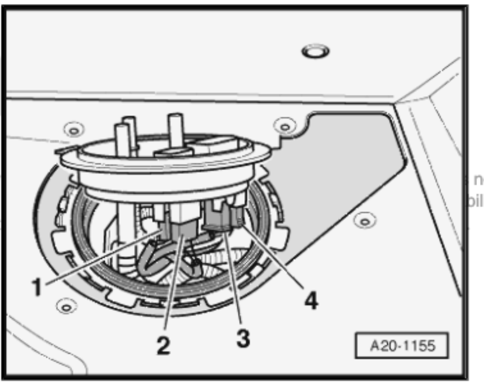
2 - Fuel delivery unit (right-side) with fuel pump - G23- .



- Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender (right-side).



- Connect electrical connectors -1 ... 4- at underside of flange.



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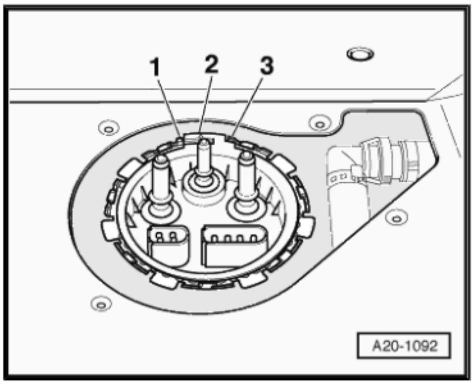
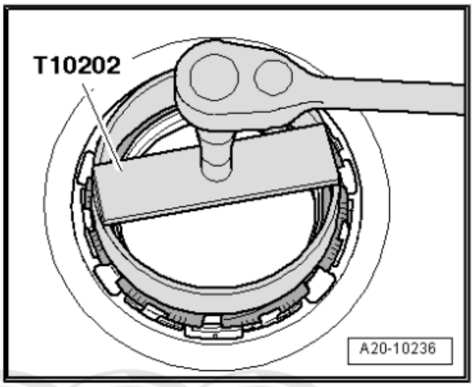
- Fit new seal for flange in fuel tank opening (seal should be dry).
- Fit flange (right-side) into fuel tank; note correct installation position:

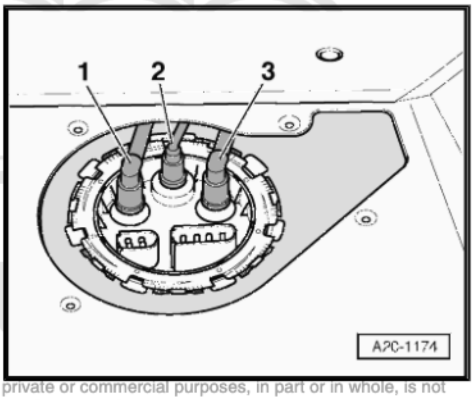
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



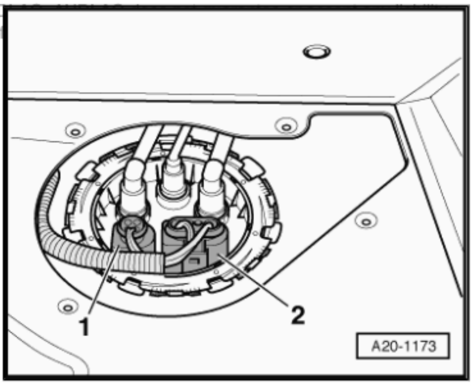
- Tighten locking ring.



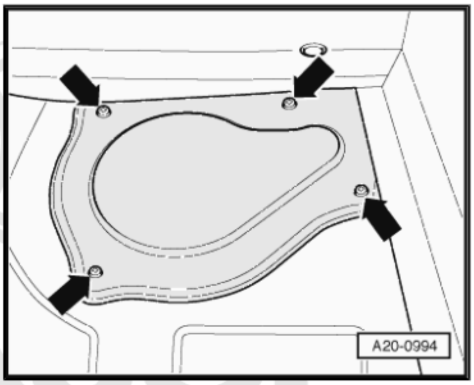
- Fit fuel return line -1- and fuel supply line -3- so that they engage audibly.
- Also fit supply line -2- going to auxiliary heater so that it engages audibly.



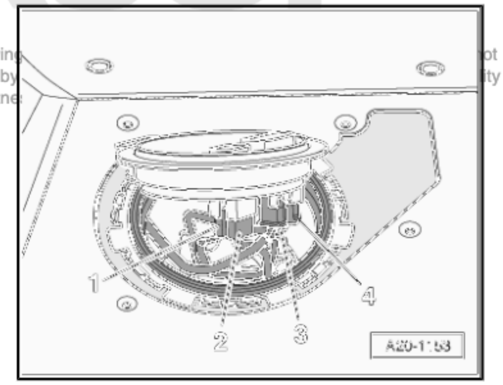
- Attach electrical connectors -1- and -2- at flange.



– Secure cover for flange (right-side) -arrows-.



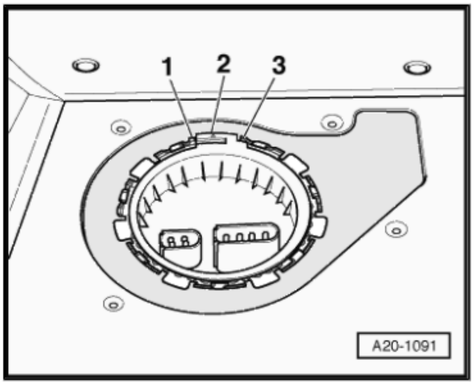
– Connect electrical connectors -1 ... 4- on underside of flange (left-side).



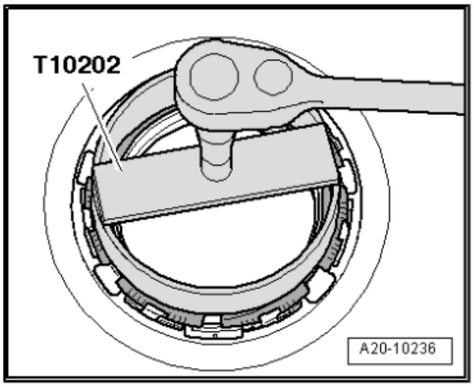
– Fit new seal for flange in fuel tank opening (seal should be dry).

– Fit flange into fuel tank; note correct installation position:

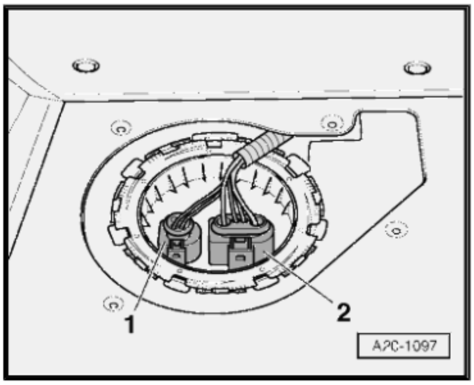
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



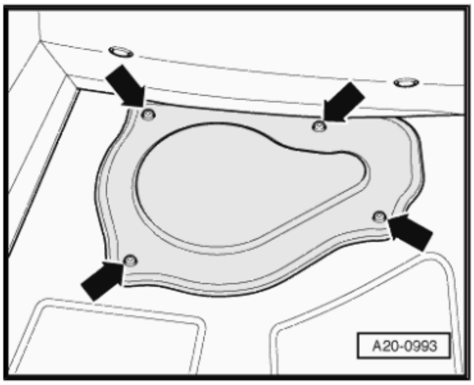
– Tighten locking ring.



- Attach electrical connectors -1- and -2- at flange.



- Secure cover for flange (left-side) -arrows-.
- Put at least 5 litres of fuel into tank after installing fuel delivery unit.
- Vehicles with auxiliary heater: Let auxiliary heater run with full load for 10 minutes to bleed fuel line leading to metering pump.



Tightening torque

Component	Nm
Locking ring for fuel delivery unit	120

1.7 Fuel delivery unit (right-side) with fuel pump - G23- ; fuel gauge sender 2 - G169- and fuel gauge sender 4 - G393- - exploded view of components

1 - Retainer

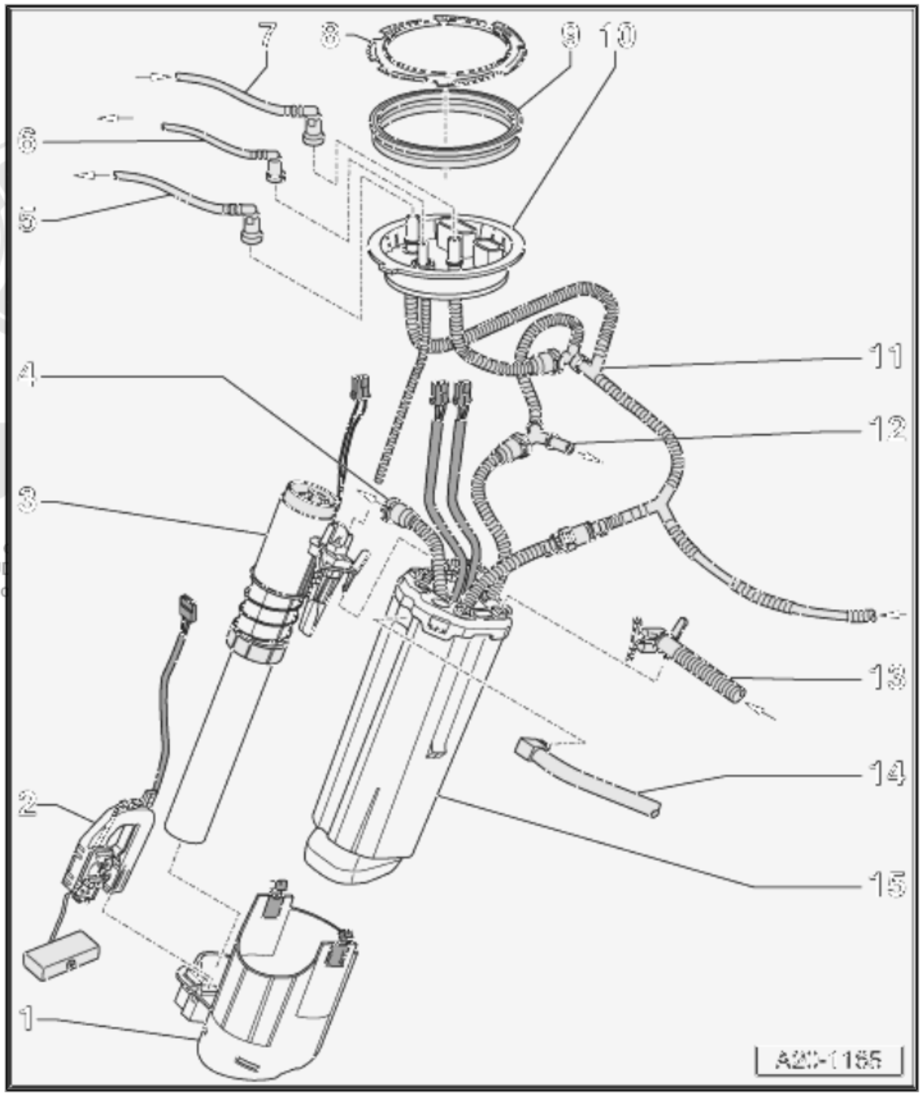
- ❑ For fuel delivery unit

2 - Fuel gauge sender 2 - G169-

- ❑ Yellow
- ❑ Clipped onto retainer ⇒ Item 1 (page 28)
- ❑ Checking resistance values ⇒ page 47
- ❑ Removing and installing ⇒ page 48

3 - Fuel gauge sender 4 - G393-

- ❑ White
- ❑ Clipped onto fuel delivery unit ⇒ Item 15 (page 29)
- ❑ Checking resistance values ⇒ page 54
- ❑ Removing and installing ⇒ page 56



4 - Supply line for suction-jet pump

- ❑ For suction-jet pump (right-side)
- ❑ Press release tab on connection piece to disconnect

5 - Fuel supply line

- ❑ To fuel filter
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

6 - Fuel line

- ❑ To auxiliary heater
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

7 - Fuel return line

- ❑ From fuel cooler
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

8 - Locking ring

- ❑ Remove and install using wrench - T10202-
- ❑ Tighten to 120 Nm

9 - Seal

- ❑ Renew

- ☐ Install dry

10 - Flange (right-side)

- ☐ Installation position ⇒ page 29

11 - Fuel supply line

- ☐ From fuel pumps (left and right) to flange
- ☐ Press release tab on connection piece to disconnect

12 - Fuel return line

- ☐ From flange to fuel delivery units (left and right)
- ☐ Press release tab on connection piece to disconnect

13 - Fuel supply line

- ☐ From suction-jet pump (left-side)
- ☐ Clipped onto fuel delivery unit ⇒ Item 15 (page 29)

14 - Fuel filler pipe

- ☐ From filler neck
- ☐ Clipped onto fuel delivery unit ⇒ Item 15 (page 29)

15 - Fuel delivery unit (right-side)

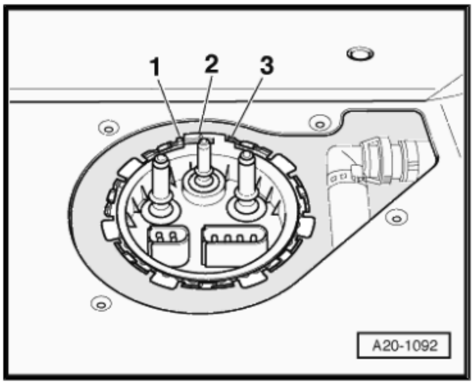
- ☐ With fuel pump - G23-
- ☐ Clipped onto retainer ⇒ Item 1 (page 28)
- ☐ Different versions are available; allocation ⇒ Parts catalogue
- ☐ Removing and installing ⇒ page 29
- ☐ Put at least 5 litres of fuel into tank after installing

Installation position of flange (right-side)

– Fit new seal for flange in fuel tank opening (seal should be dry).

– Fit flange into fuel tank; note correct installation position:

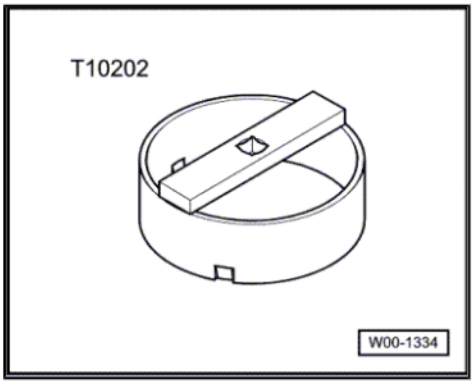
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



1.8 Removing and installing fuel delivery unit (right-side) with fuel pump - G23-

Special tools and workshop equipment required

◆ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

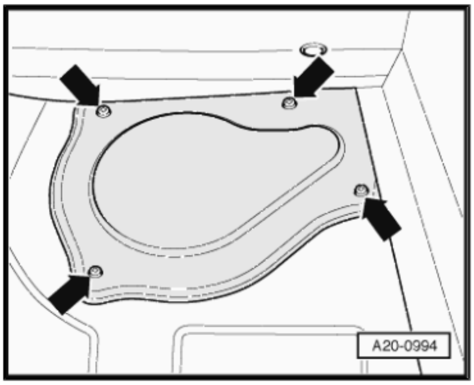
- The fuel tank must not be more than $^{1}/_{3}$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 7

Note

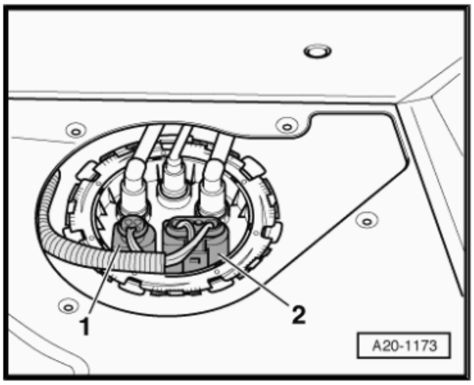
For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Remove luggage compartment floor lining.

– Unscrew cover for flange (right-side) -arrows-.



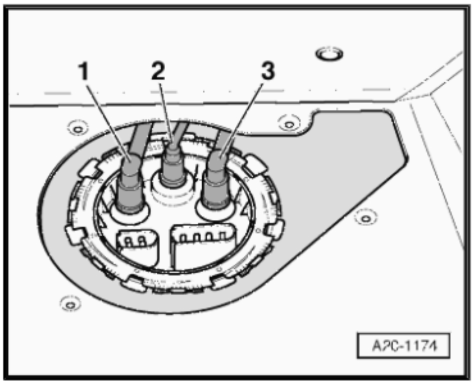
– Unplug electrical connectors -1- and -2- at flange.



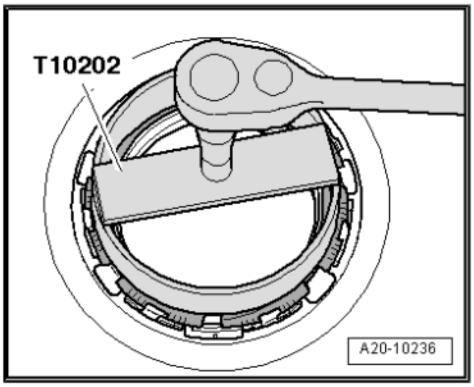
– Mark fuel return line -1- and fuel supply line -3-.

– Detach both lines from flange (press release tabs).

– In addition, disconnect fuel line -2- leading to metering pump for auxiliary heater (press release tab).

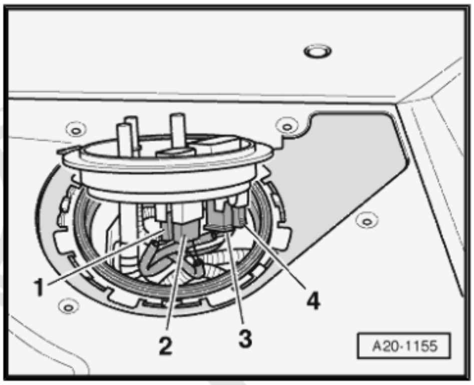


– Unscrew locking ring using wrench - T10202- .



– Detach flange and remove seal.

– Detach electrical connectors -1 ... 4- at underside of flange.

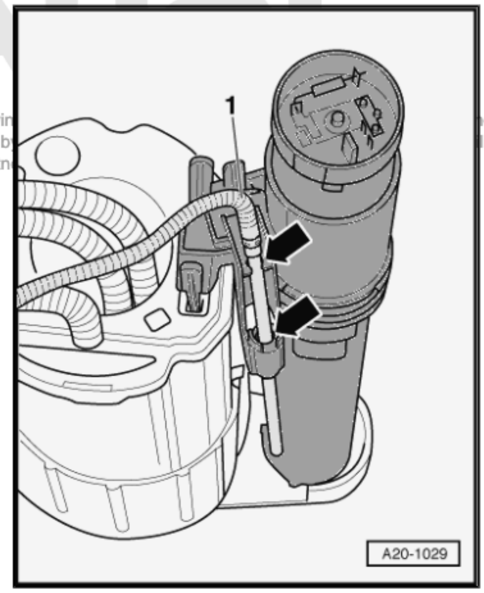


Note

◆ *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*

◆ *Some of the components are shown removed in the following illustration.*

– Pull out suction pipe -1- for auxiliary heater from retainer -arrows- on tubular sender (right-side).



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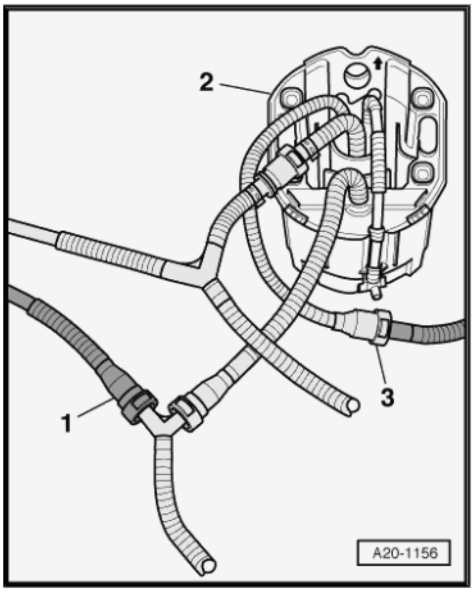
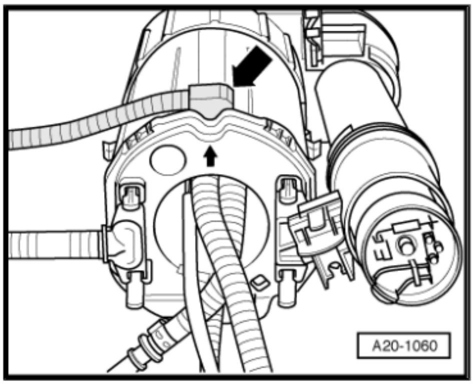
- Working through right fuel tank opening, press release tab and disconnect fuel line -1- going to fuel delivery unit (left-side).
- Press release tab and disconnect fuel line -3- going to suction jet pump (right-side).

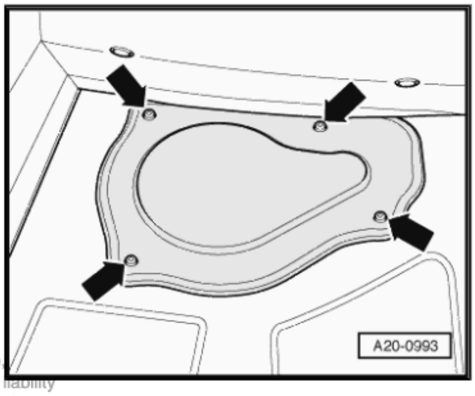
2 - Fuel delivery unit (right-side) with fuel pump - G23- .



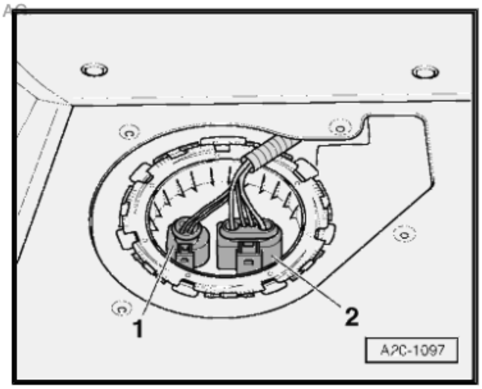
- Unclip fuel filler pipe -arrow- at front of fuel delivery unit (right-side).



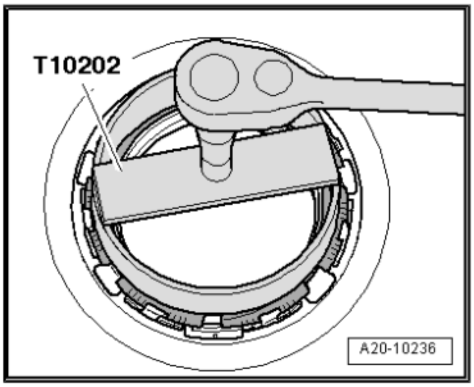
- Detach cover for flange (left-side) -arrows-.



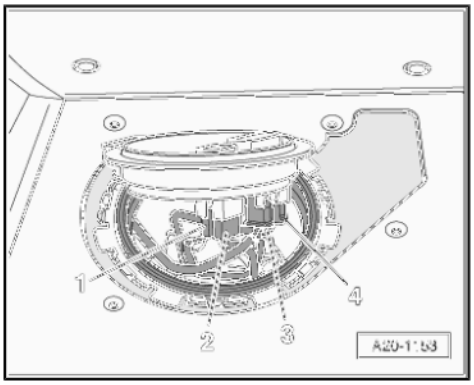
- Unplug electrical connectors -1- and -2- at flange.



- Unscrew locking ring using wrench - T10202- .



- Detach flange and remove seal.
- Detach electrical connectors -1 ... 4- at underside of flange.

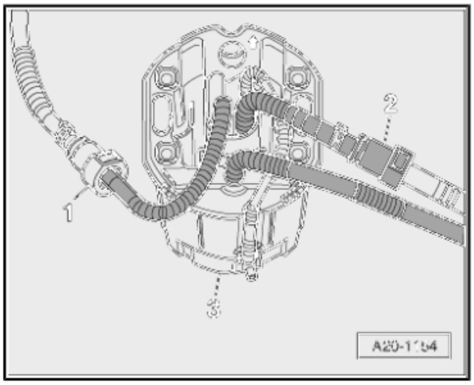


- Working through left fuel tank opening, press release tab and disconnect fuel supply line -2- going to fuel delivery unit (right-side).
- Pull disconnected fuel supply line out of the right fuel tank opening.

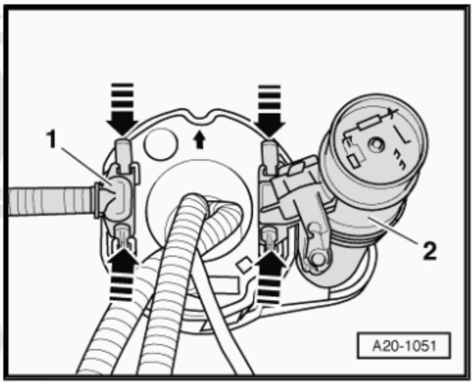
3 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6- .

Note

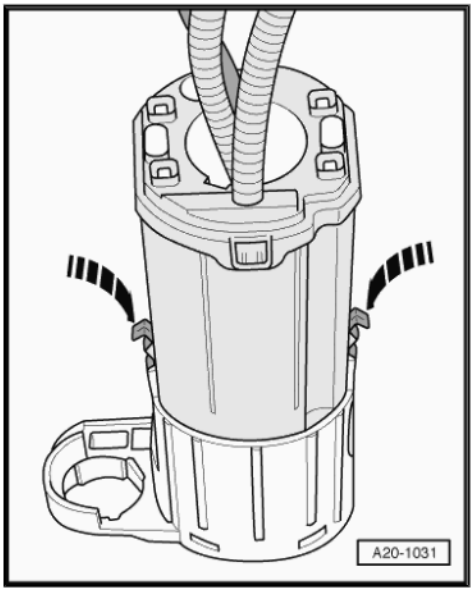
Disregard -item 1-.



- Working through right fuel tank opening, press release tabs -arrows- and detach supply line -1- and fuel gauge sender 4 - G393- -item 2-.
- Move fuel gauge sender 4 - G393- to right side.



- Press down both retaining clips on retainer for fuel delivery unit (right-side) -arrows-.
- Remove fuel delivery unit.

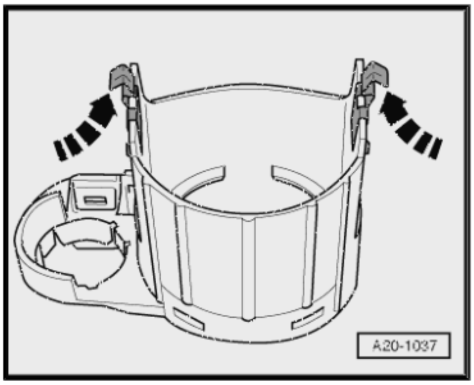


Note

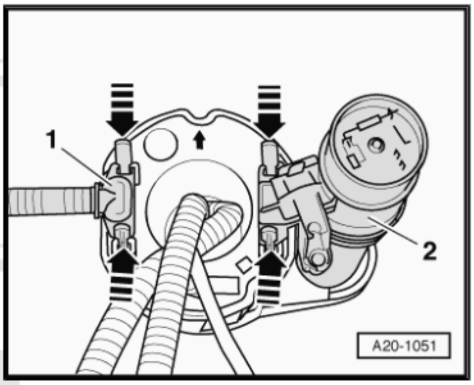
Keep in mind that the fuel delivery unit still contains fuel.

Installing

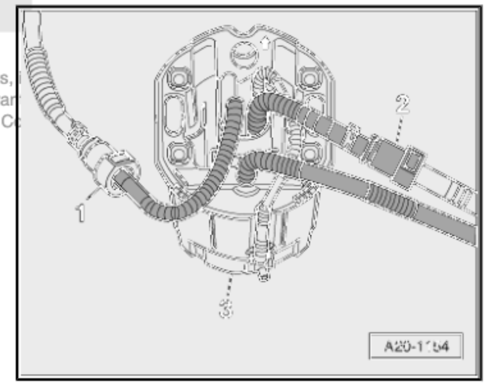
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing fuel delivery unit (right-side).
- Then press fuel delivery unit carefully into retainer so that it engages audibly.



- Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly on fuel delivery unit (right-side).



- Fit fuel lines -2- through left opening on fuel tank so that they engage audibly.

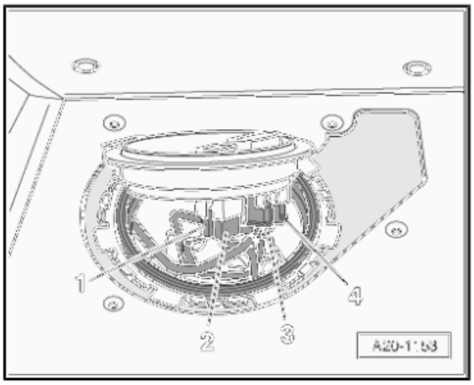


3 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6- .

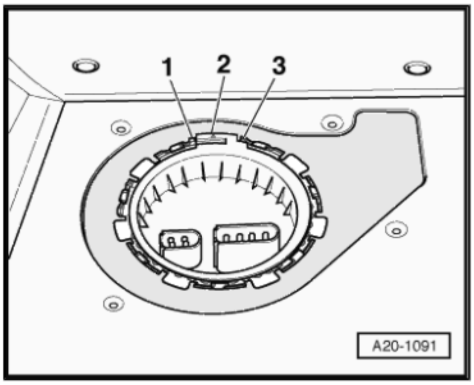
Note

Disregard -item 1-.

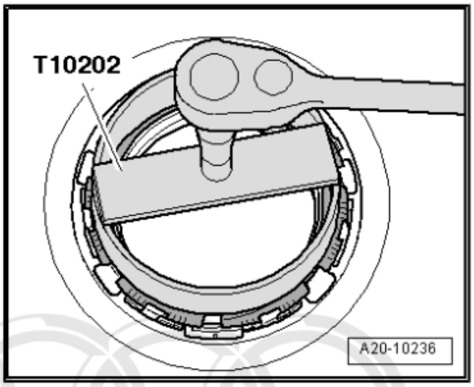
- Connect electrical connectors -1 ... 4- at underside of flange.



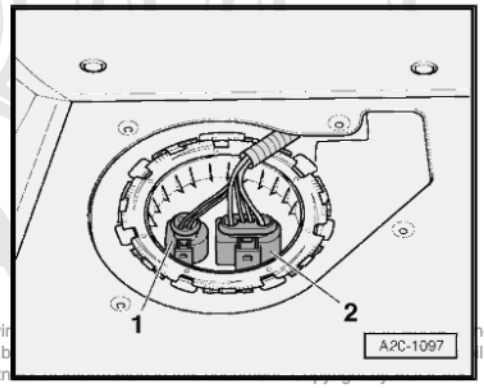
- Fit new seal for flange in fuel tank opening (seal should be dry).
- Fit flange (left-side) into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



- Tighten locking ring.



- Attach electrical connectors -1- and -2- at flange.



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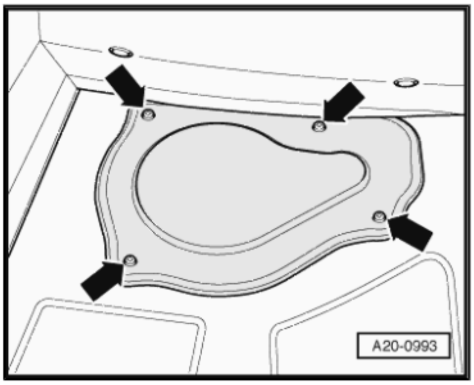
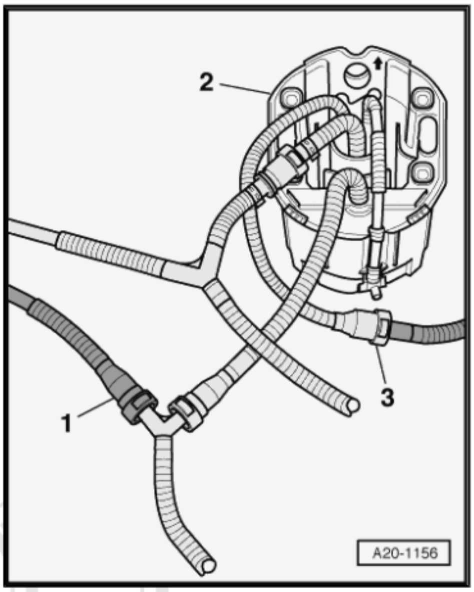
– Secure cover for flange -arrows-.

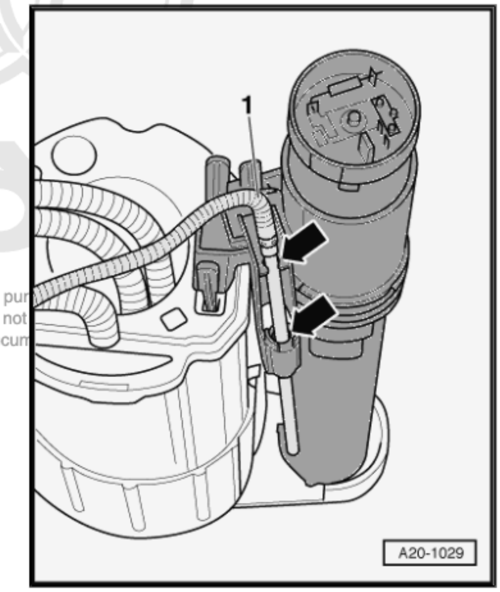


– Fit fuel lines -1- and -3- through right fuel tank opening so that they engage audibly.

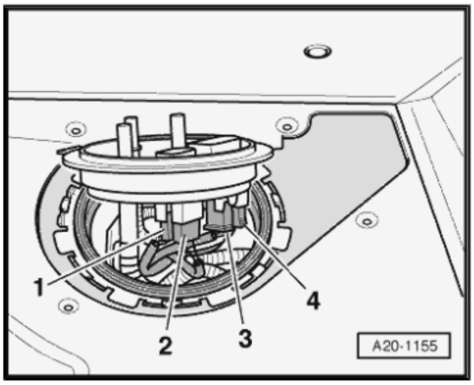
2 - Fuel delivery unit (right-side) with fuel pump - G23- .



– Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender (right-side).

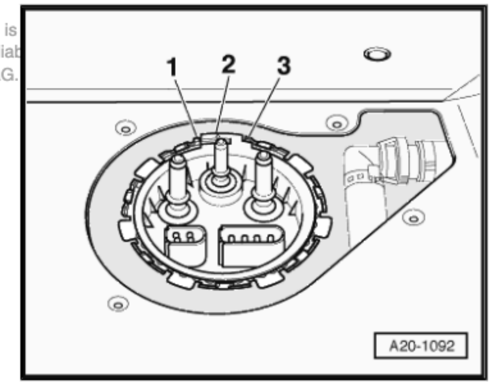


- Connect electrical connectors -1 ... 4- at underside of flange.

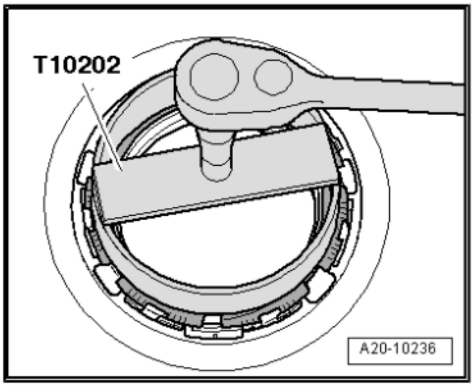


- Fit new seal for flange in fuel tank opening (seal should be dry).
- Fit flange (right-side) into fuel tank; note correct installation position:

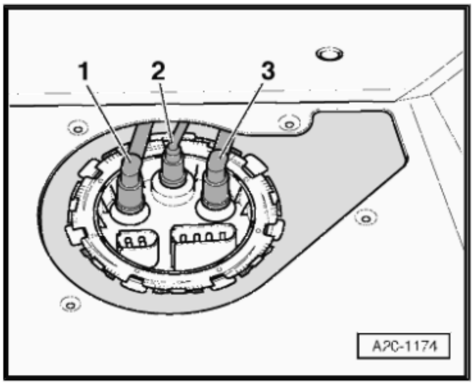
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



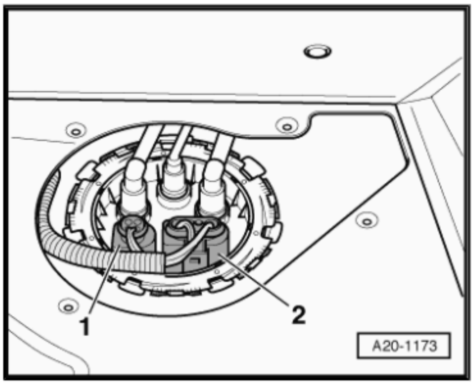
- Tighten locking ring.



- Fit fuel return line -1- and fuel supply line -3- so that they engage audibly.
- Also fit supply line -2- going to auxiliary heater so that it engages audibly.



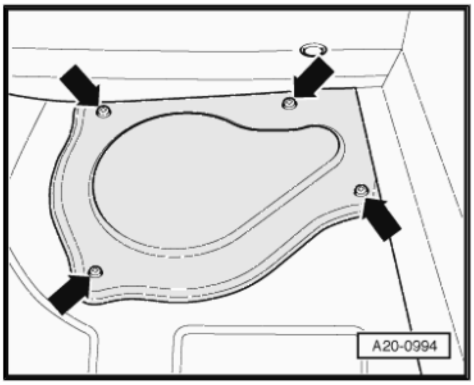
– Attach electrical connectors -1- and -2- at flange.



– Secure cover for flange (right-side) -arrows-.

– Put at least 5 litres of fuel into tank after installing fuel delivery unit.

– Vehicles with auxiliary heater: Let auxiliary heater run with full load for 10 minutes to bleed fuel line leading to metering pump.



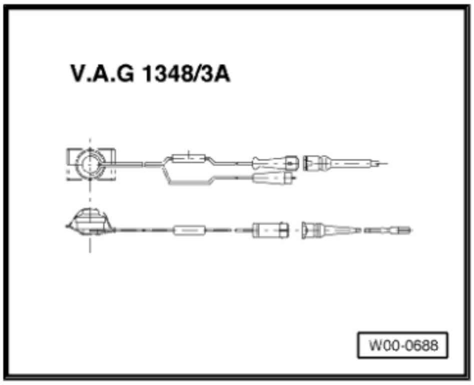
Tightening torque

Component	Nm
Locking ring for fuel delivery unit	120

1.9 Checking fuel pump delivery rate

Special tools and workshop equipment required

- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2-



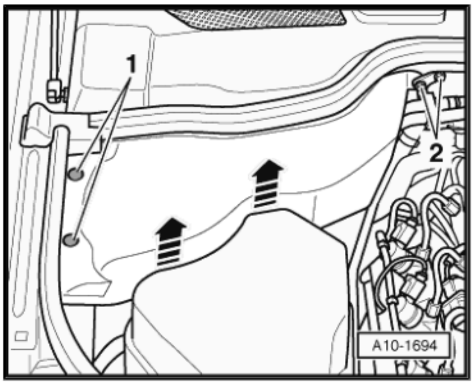
- Fuel-resistant measuring container

Test sequence

– Observe test conditions ⇒ page 3 .

– If fitted, remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew bolted joint -2-.

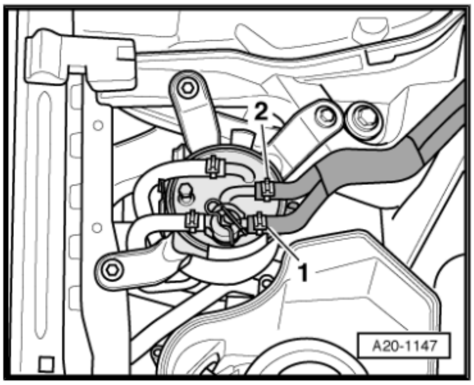
– Pull cover out of retainers -arrows-.



Caution

Rules for cleanliness when working on the injection system ⇒ page 3 .

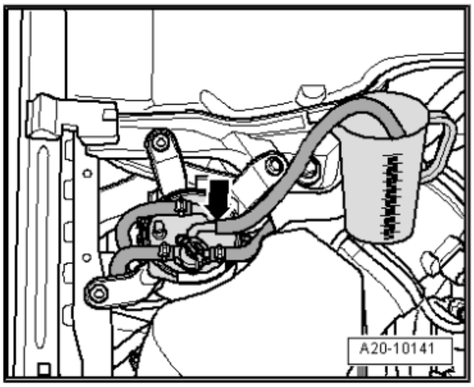
– Disconnect fuel supply line -2- going to engine at fuel filter.



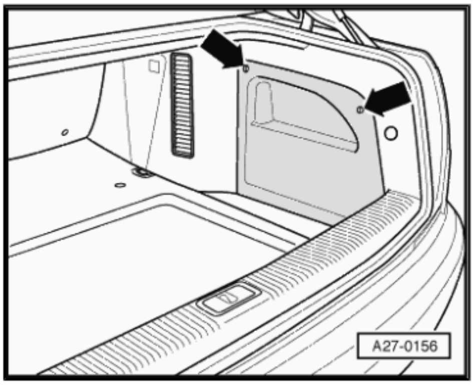
Note

Disregard -item 1-.

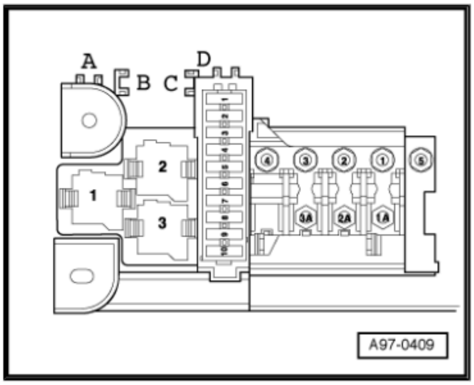
– Fit auxiliary hose -arrow- onto connection at fuel filter and hold it into a measuring container to catch fuel.

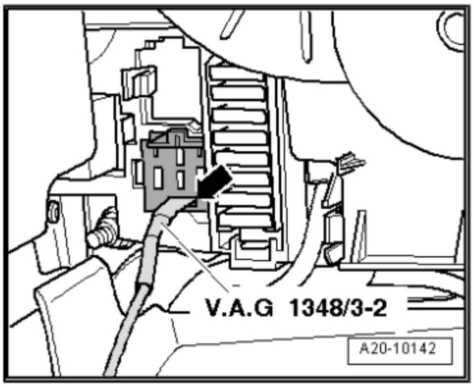


– Remove luggage compartment side trim cover (right-side) -arrows-.

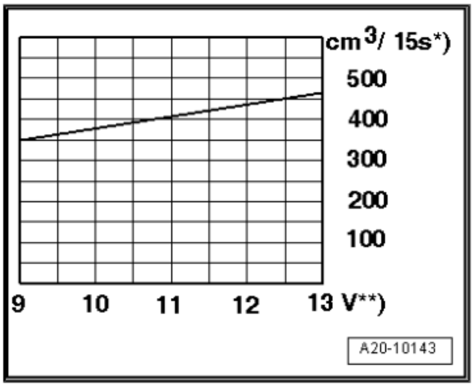


– Disconnect fuel pump relay - J17- located at position -3- on relay and fuse holder in luggage compartment (right-side).





- Connect remote control - V.A.G 1348/3 A- with adapter cable - V.A.G 1348/3-2- to contact 2 -arrow- in fuel pump relay socket.
- Connect crocodile clip of remote control - V.A.G 1348/3 A- to vehicle battery “+” (positive).



- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).

Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pumps are defective.

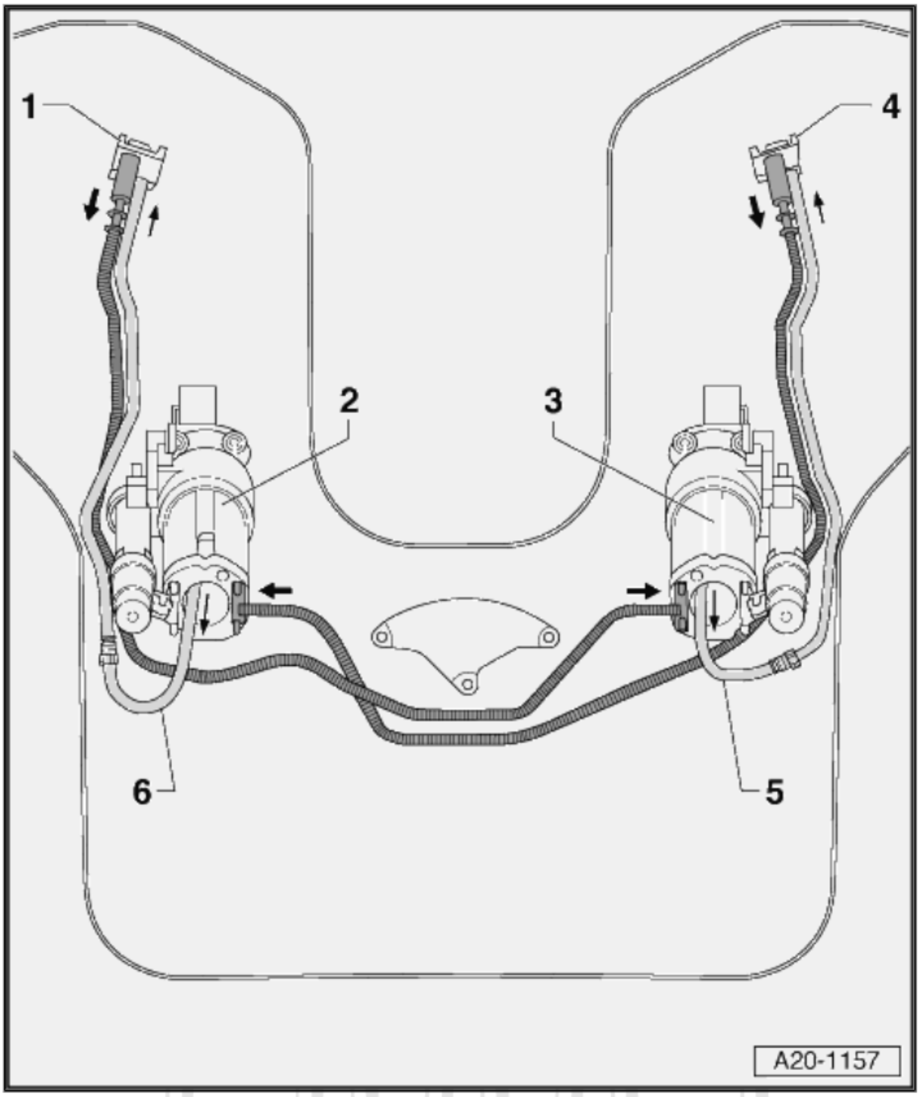
Note

As there is hardly any difference in the delivery rate if only one of the two fuel pumps is working – because of the hose connections inside the tank – it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

- Unplug electrical connector for fuel delivery unit (left-side).
- Measure delivery rate.
- Unplug electrical connector for fuel delivery unit (right-side).
- Measure delivery rate.
- If delivery rate differs considerably from specification, renew relevant fuel delivery unit.

1.10 Suction-jet pumps: operation



1 - Suction-jet pump (left-side)

2 - Fuel delivery unit (left-side)

3 - Fuel delivery unit (right-side)

4 - Suction-jet pump (right-side)

5 - Fuel pump (right-side)

6 - Fuel pump (left-side)

Description of operation
To ensure a reliable fuel supply in all situations, the fuel pumps must never draw in air, even under extreme driving conditions such as very sharp bends or under heavy braking. This may happen when the fuel sloshes into one of the corners of a partially filled fuel tank.

- For this reason, the fuel delivery units ⇒ Item 2 (page 41) and ⇒ Item 3 (page 41) incorporate a so-called baffle housing, into which the fuel pumps are inserted, as well as the fuel pumps themselves. The baffle housing is a container permanently filled with fuel, so that the fuel pumps are surrounded with fuel regardless of the fuel level in the tank.
- Consequently, proper filling of the baffle housings is essential for trouble-free operation of the fuel pumps. This is the purpose of the suction jet pumps.
- The suction-jet pumps operate according to the principle of fluid entrainment: a stream of fuel from the primary stage of the fuel pump (right-side) ⇒ Item 5 (page 41) or (left-side) ⇒ Item 6 (page 41) is passed through a nozzle in the suction-jet pumps ⇒ Item 4 (page 41) and ⇒ Item 1 (page 41) , and is thus accelerated. The accelerated stream of fuel draws off the surrounding fuel and delivers it to the baffle housings in the fuel delivery units. The suction jet pump (right-side) ⇒ Item 4 (page 41) delivers the fuel to the baffle housing (left-side); the suction jet pump (left-side) ⇒ Item 1 (page 41) delivers the fuel to the baffle housing (right-side).

1.11 Removing and installing suction-jet pump (left-side)

Removing

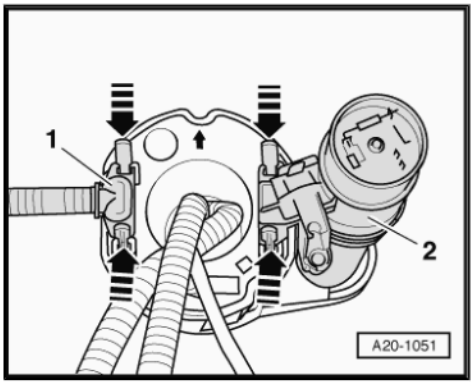
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

– Remove the fuel delivery unit (left-side) ⇒ page 18 .

– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

- Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1-.

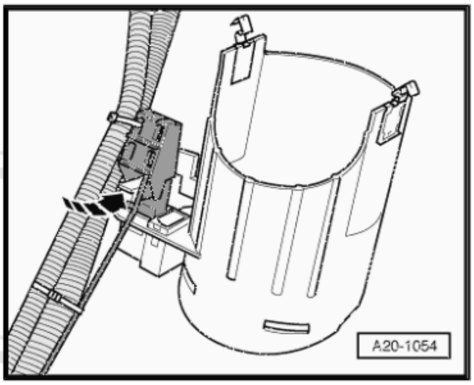


Note

Disregard -item 2-.

- Pull out disconnected fuel supply line -1- through left fuel tank opening.

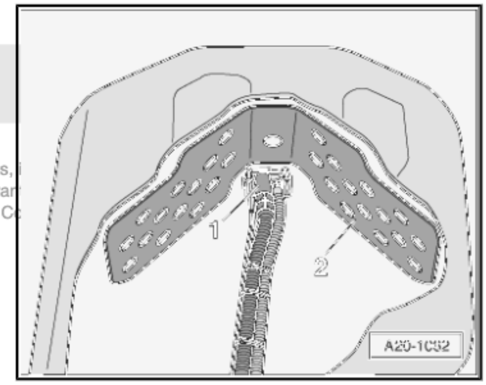
- Working through left fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.
- Pull out suction-jet pump (left-side) together with lines through left fuel tank opening.



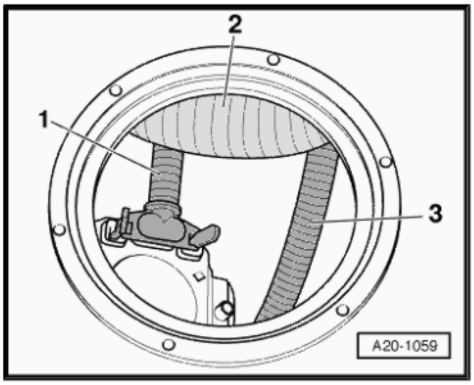
Installing

- Insert suction-jet pump (left-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.
- Then press retaining clip for suction-jet pump into retainer so it engages audibly.

purposes,
permitted unless authorised by AUDI AG. AUDI AG does not guaran
with respect to the correctness of information in this document. Co



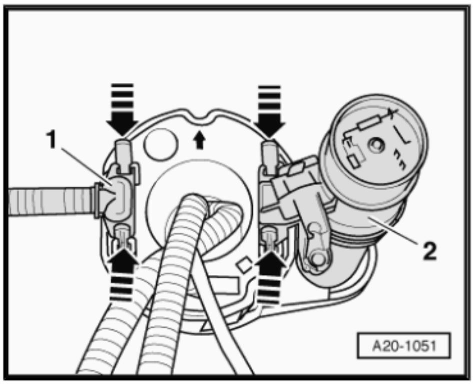
- Push fuel supply line -3- through left fuel tank opening into right fuel tank chamber. Note routing:
- The supply line -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



Note

Disregard -item 1-.

- Fit fuel supply line -1- onto fuel delivery unit (right-side) so that the locking hooks engage audibly.



Note

Disregard -item 2-.

- Insert fuel gauge sender 3 - G237- (tubular sender, left-side) into fuel tank.
- Install fuel delivery unit (left-side) ⇒ page 23 .

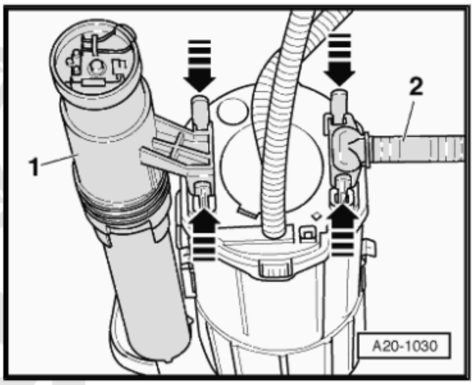
1.12 Removing and installing suction-jet pump (right-side)

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

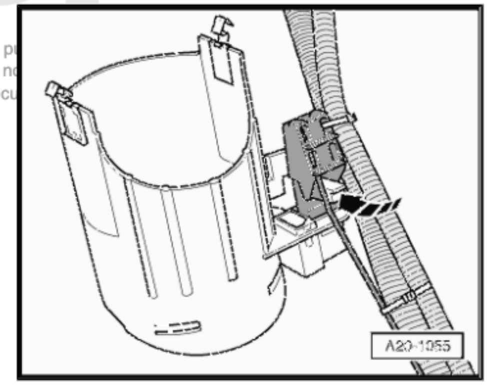
- Remove fuel delivery unit (right-side) ⇒ page 29 .
- Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.
- Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2-.



Note

Disregard -item 1-.

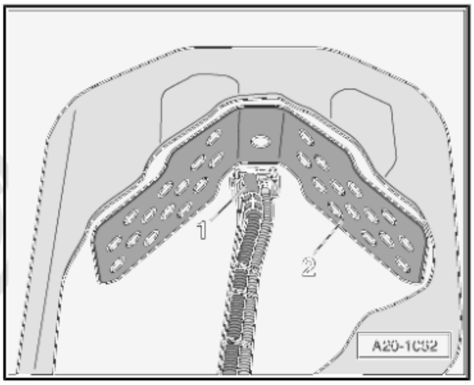
- Pull out disconnected fuel supply line -2- from right fuel tank opening.



- Working through right fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.
- Pull suction-jet pump (right-side) together with lines out of right fuel tank opening.

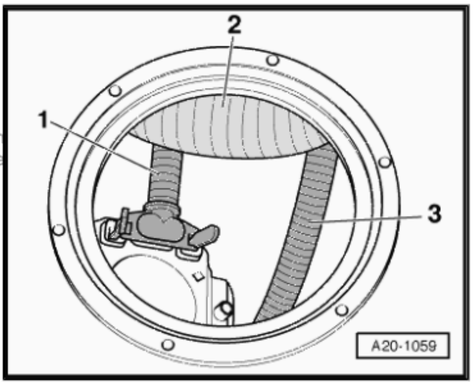
Installing

- Insert suction-jet pump (right-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.
- Then press retaining clip for suction-jet pump into retainer so it engages audibly.



- Push fuel supply line -1- through right fuel tank opening into left fuel tank chamber. Note routing:

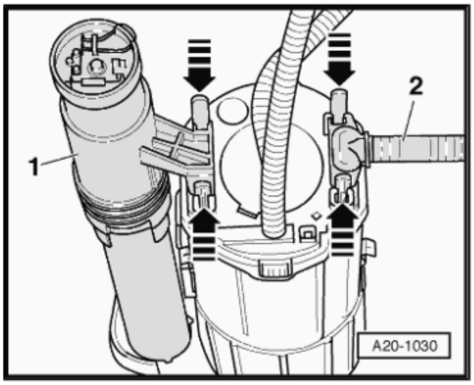
- The supply line -1- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



Note

Disregard -item 3-.

- Fit fuel supply line -2- onto fuel delivery unit (left-side) so that the locking hooks engage audibly.



Note

Disregard -item 1-.

- Insert fuel gauge sender 4 - G393- (tubular sender, right-side) into fuel tank.
- Install fuel delivery unit (right-side) ⇒ page 34 .

2 Fuel gauge senders

⇒ “2.1 Checking fuel gauge sender G (lever-type sender, left-side)”, page 45

⇒ “2.2 Removing and installing fuel gauge sender G (lever-type sender, left-side)”, page 46

⇒ “2.3 Checking fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 47

⇒ “2.4 Removing and installing fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 48

⇒ “2.5 Checking fuel gauge sender 3 G237 (tubular sender, left-side)”, page 49

⇒ “2.6 Removing and installing fuel gauge sender 3 G237 (tubular sender, left-side)”, page 50

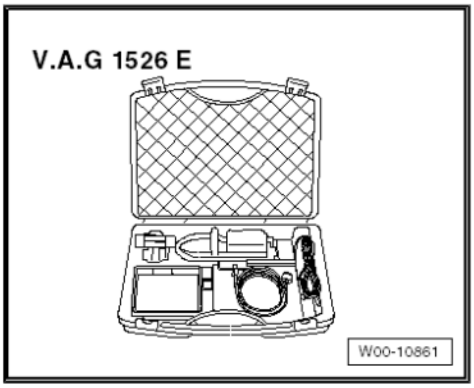
⇒ “2.7 Checking fuel gauge sender 4 G393 (tubular sender, right-side)”, page 54

⇒ “2.8 Removing and installing fuel gauge sender 4 G393 (tubular sender, right-side)”, page 56

2.1 Checking fuel gauge sender - G- (lever-type sender, left-side)

Special tools and workshop equipment required

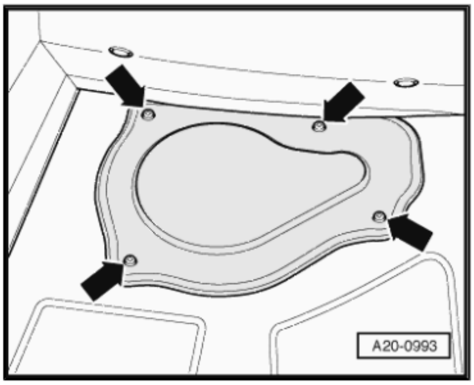
- Hand-held multimeter - V.A.G 1526 E-



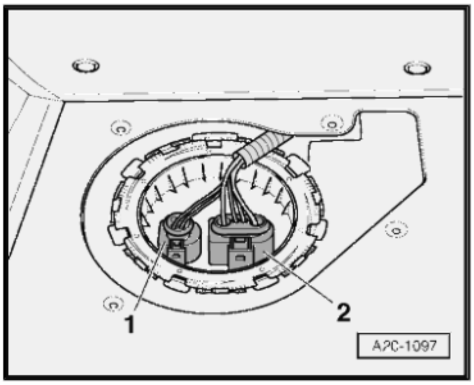
- Auxiliary measuring set - V.A.G 1594 C-

Test sequence

- Remove luggage compartment floor lining.
- Detach cover for flange (left-side) -arrows-.



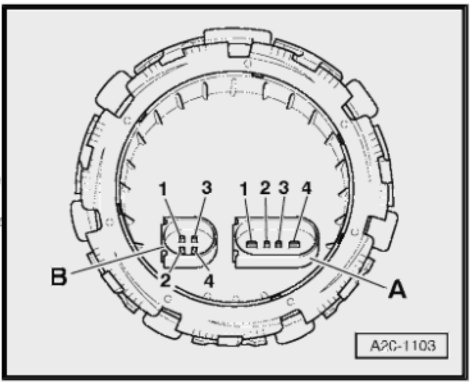
- Unplug electrical connector -1- at flange.



Note

Disregard -item 2-.

- Connect hand-held multimeter - V.A.G 1526 E- between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 700 Ω	approx. 55 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum resistance values for “tank full” and “tank empty”, remove the fuel gauge sender - G- ⇒ page 46 and move the float all the way to its top or bottom position.*
- *The following values are obtained with the fuel gauge sender - G- removed, due to the greater travel of the float arm:*

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 990 Ω	approx. 55 Ω

Assemble in reverse order.

2.2 Removing and installing fuel gauge sender - G- (lever-type sender, left-side)

Removing

Observe safety precautions ⇒ page 1 .

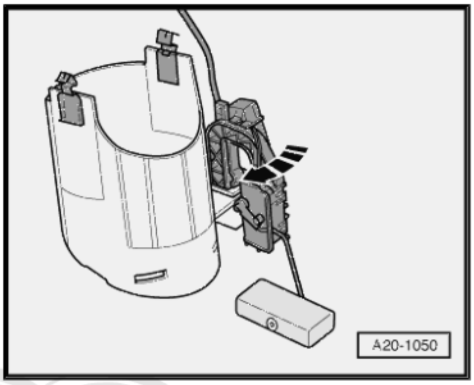
Observe rules for cleanliness ⇒ page 3 .

- The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 7 .

– Remove the fuel delivery unit (left-side) ⇒ page 18 .

– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

– Release fuel gauge sender - G- -arrow- and detach from retainer.



Installing

– Press fuel gauge sender - G- into retainer so that it engages audibly.

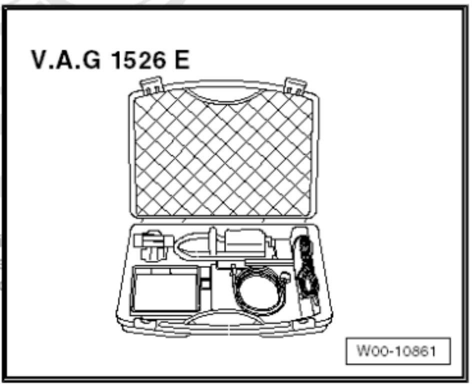
– Insert fuel gauge sender 3 - G237- into fuel tank.

– Install fuel delivery unit (left-side) ⇒ page 23 .

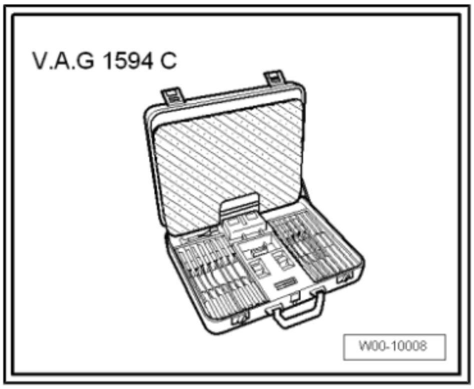
2.3 Checking fuel gauge sender 2 - G169- (lever-type sender, right-side)

Special tools and workshop equipment required

◆ Hand-held multimeter - V.A.G 1526 E-

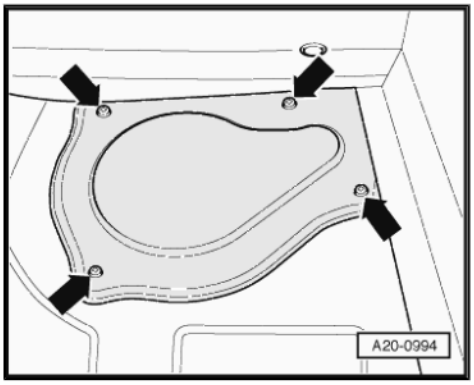


◆ Auxiliary measuring set - V.A.G 1594 C-

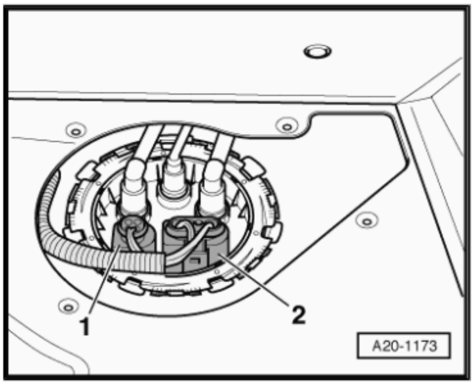


Test sequence

- Remove luggage compartment floor lining.
- Unscrew cover for flange (right-side) -arrows-.



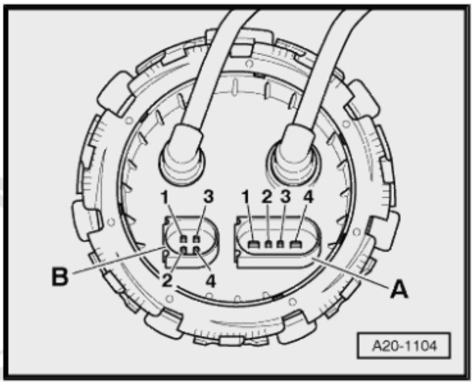
- Unplug electrical connector -1- at flange.



Note

Disregard -item 2-.

- Connect hand-held multimeter - V.A.G 1526 E- between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 750 Ω	approx. 55 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for “tank full” and “tank empty”, remove the fuel gauge sender 2 - G169- ⇒ page 48 and move the float all the way to its top or bottom position.*
- *The following values are obtained with the fuel gauge sender 2 - G169- removed, due to the greater travel of the float arm:*

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 990 Ω	approx. 55 Ω

2.4 Removing and installing fuel gauge sender 2 - G169- (lever-type sender, right-side)

Removing

Observe safety precautions ⇒ page 1 .

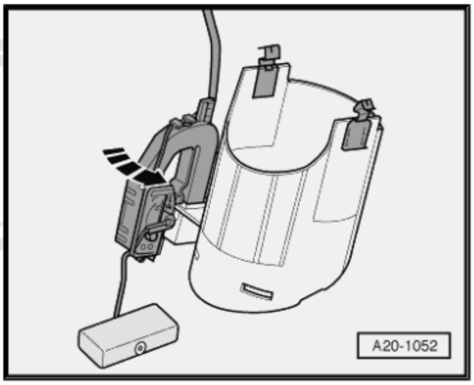
Observe rules for cleanliness ⇒ page 3 .

- The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 7 .

– Remove fuel delivery unit (right-side) ⇒ page 29 .

– Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.

– Release fuel gauge sender 2 - G169- -arrow- and detach from retainer.



Installing

– Press fuel gauge sender 2 - G169- into retainer so that it engages audibly.

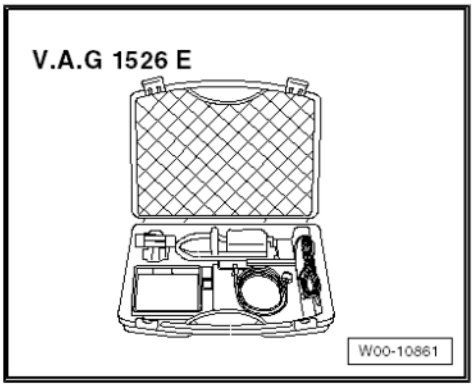
– Insert fuel gauge sender 4 - G393- into fuel tank.

– Install fuel delivery unit (right-side) ⇒ page 34 .

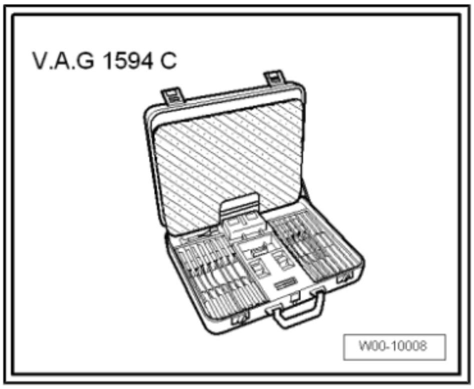
2.5 Checking fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

- Hand-held multimeter - V.A.G 1526 E-

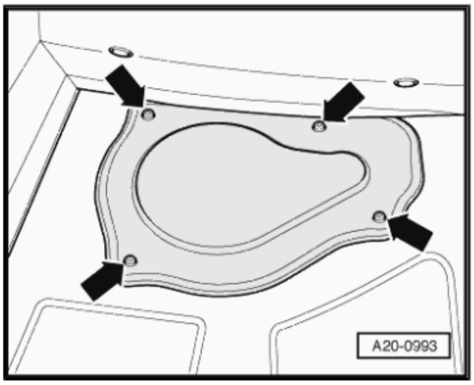


- Auxiliary measuring set - V.A.G 1594 C-

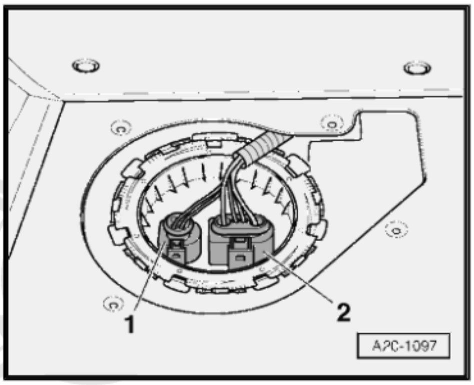


Test sequence

- Remove luggage compartment floor lining.
- Detach cover for flange (left-side) -arrows-.



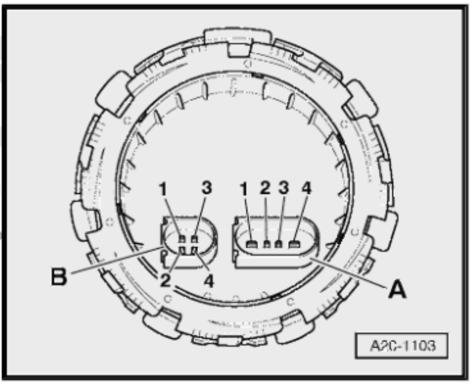
- Unplug electrical connector -2- at flange.



Note

Disregard -item 1-.

- Connect hand-held multimeter - V.A.G 1526 E- between contacts -2- and -3- of connector -A- to measure resistance.



Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 3 - G237-	approx. 155 Ω	approx. 70 Ω

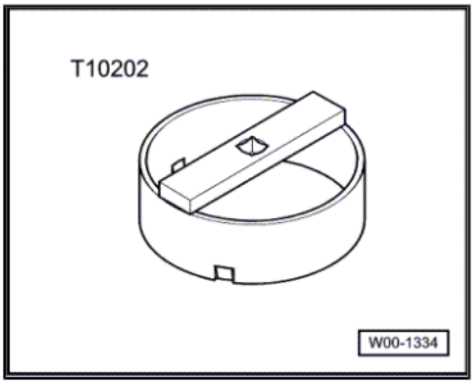
Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for “tank full” and “tank empty”, remove the fuel gauge sender 3 - G237- ⇒ page 50 and move the float all the way to its top or bottom position.*

2.6 Removing and installing fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

- ♦ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

- The left fuel tank chamber must not be more than $^1/_3$ full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 7 .

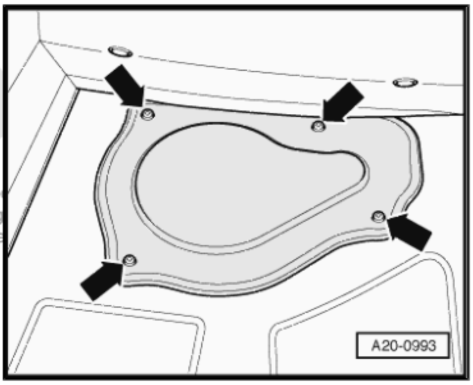
– Briefly open filler cap for fuel tank and close again.

Note

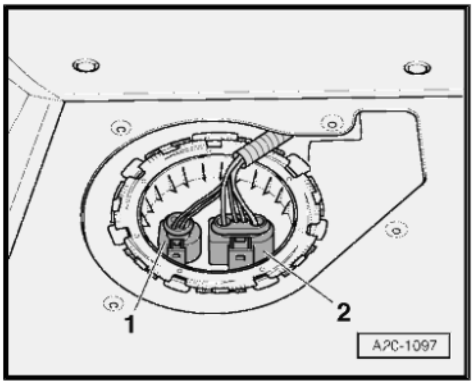
For removing and installing tubular sender, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Remove luggage compartment floor lining.

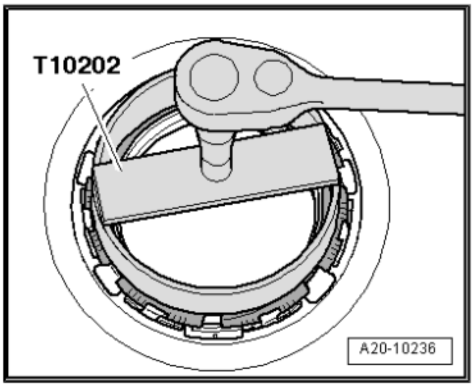
– Detach cover for flange (left-side) -arrows-.



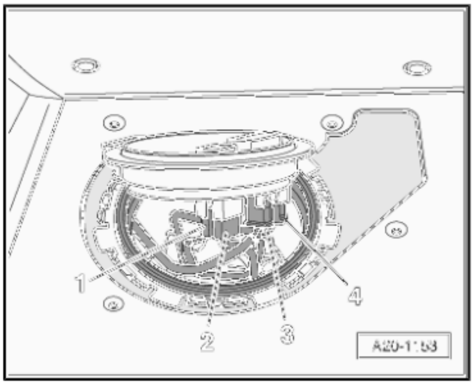
– Unplug electrical connectors -1- and -2- at flange.



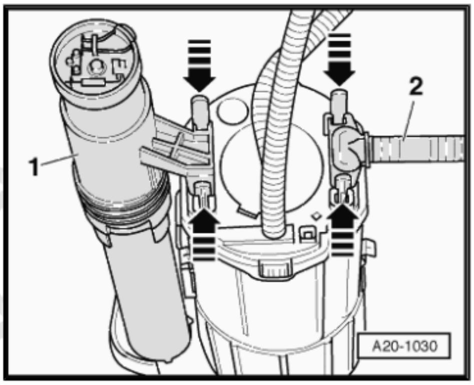
- Unscrew locking ring using wrench - T10202- .



- Detach flange and remove seal.
- Detach electrical connectors -1 ... 4- at underside of flange.



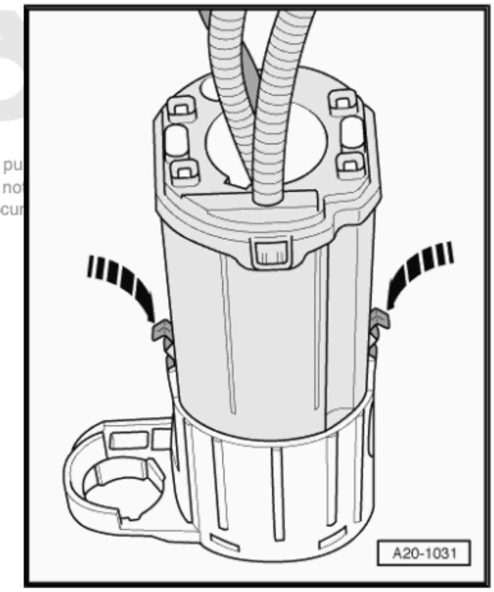
- Working through left fuel tank opening, press release tabs -arrows- and detach supply line -2- and fuel gauge sender 3 - G237- -item 1-.
- Move fuel gauge sender 3 - G237- to left side.



- Press down both retaining clips on retainer for fuel delivery unit (left-side) -arrows-.
- Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 3 - G237- .

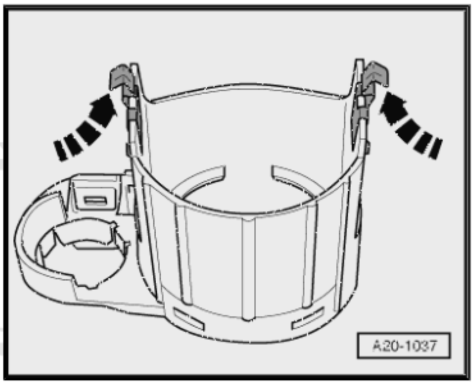
Note

Keep in mind that the fuel gauge sender 3 - G237- still contains fuel.

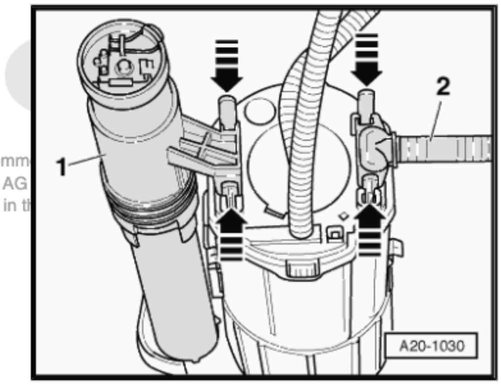


Installing

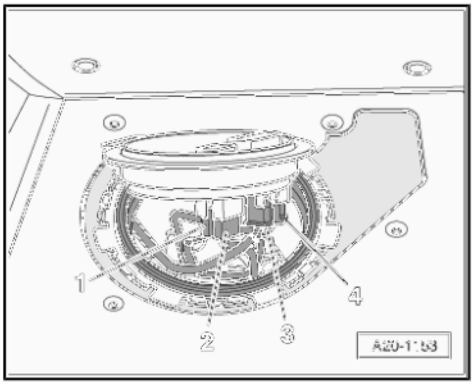
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit (left-side).
- Then press fuel delivery unit carefully into retainer so that it engages audibly.



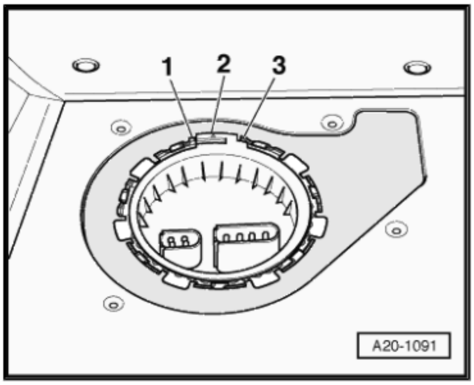
- Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.



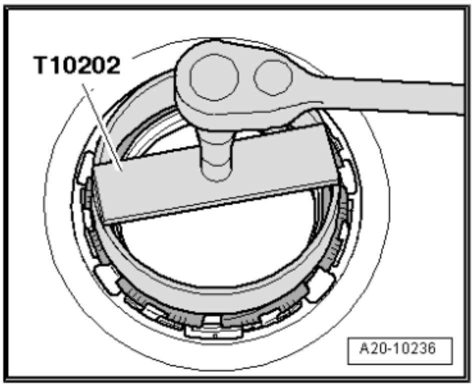
- Connect electrical connectors -1 ... 4- at underside of flange.



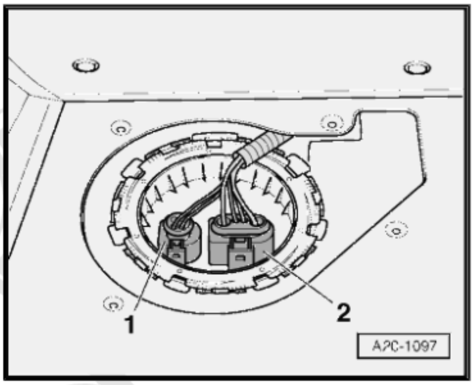
- Fit new seal for flange in fuel tank opening (seal should be dry).
- Fit flange (left-side) into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



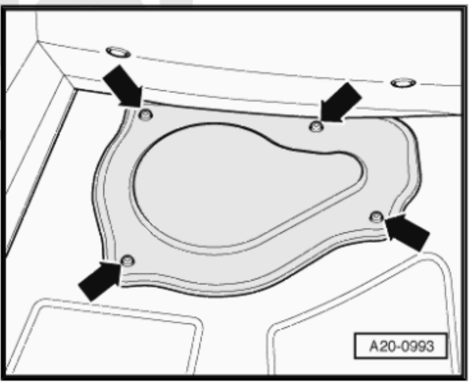
- Tighten locking ring.



- Attach electrical connectors -1- and -2- at flange.



- Secure cover for flange (left-side) -arrows-.



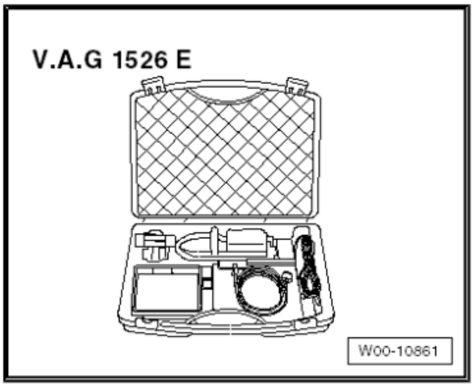
Tightening torque

Component	Nm
Locking ring for fuel delivery unit	120

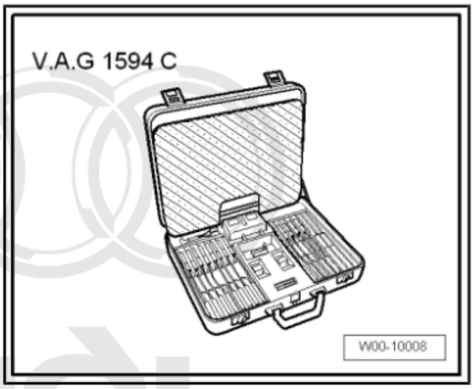
2.7 Checking fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

- ♦ Hand-held multimeter - V.A.G 1526 E-



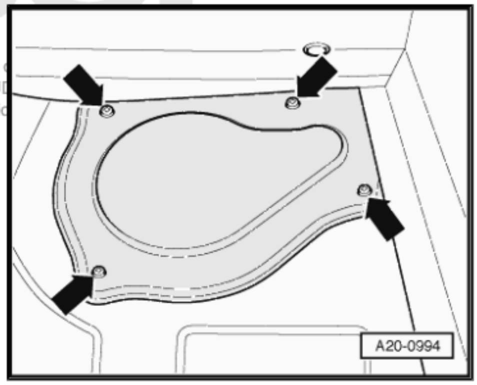
- Auxiliary measuring set - V.A.G 1594 C-



Test sequence

– Remove luggage compartment floor lining.

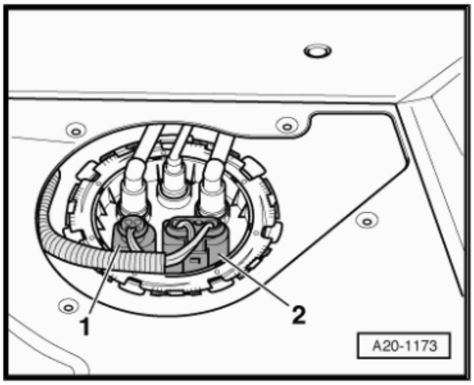
– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- at flange.

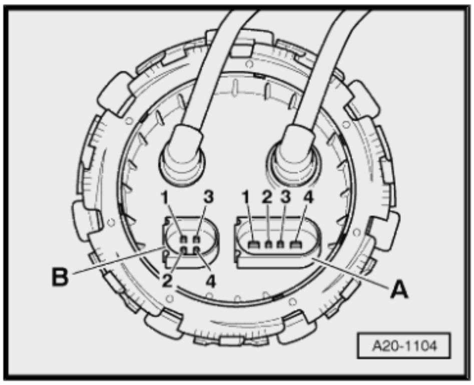
Note

Disregard -item 1-.



– Connect hand-held multimeter - V.A.G 1526 E- between contacts -2- and -3- of connector -A- to measure resistance.

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 4 - G393-	approx. 155 Ω	approx. 70 Ω



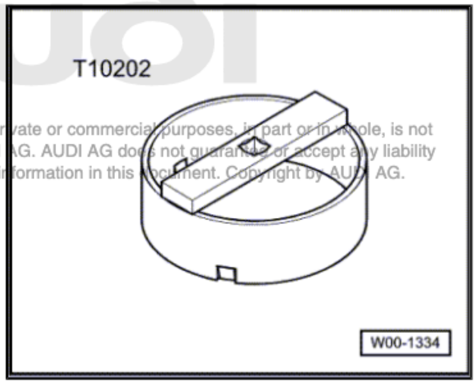
Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for “tank full” and “tank empty”, remove the fuel gauge sender 4 - G393- ⇒ page 56 and move the float all the way to its top or bottom position.*

2.8 Removing and installing fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

- Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

- The right fuel tank chamber must not be more than $^1/_3$ full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 7 .

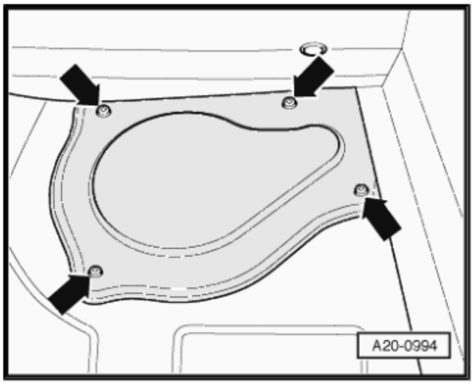
– Briefly open filler cap for fuel tank and close again.

Note

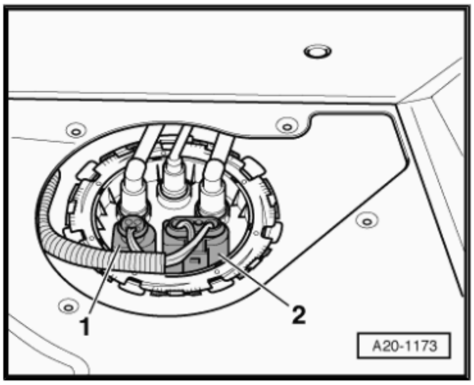
For removing and installing tubular sender, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Remove luggage compartment floor lining.

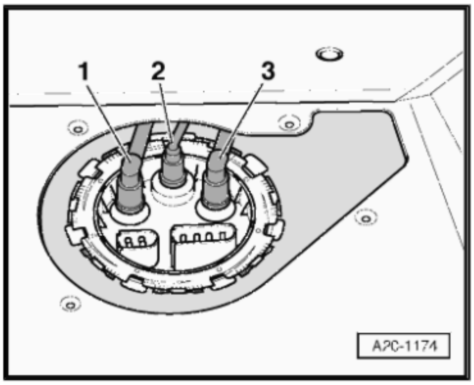
– Unscrew cover for flange (right-side) -arrows-.



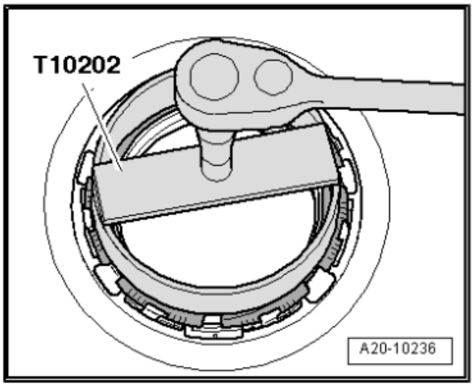
- Unplug electrical connectors -1- and -2- at flange.



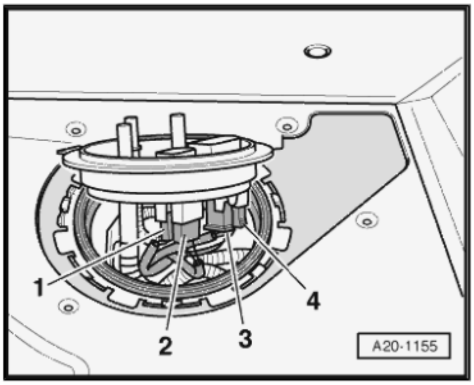
- Mark fuel return line -1- and fuel supply line -3-.
- Detach both lines from flange (press release tabs).
- In addition, disconnect fuel line -2- leading to metering pump for auxiliary heater (press release tab).



- Unscrew locking ring using wrench - T10202- .



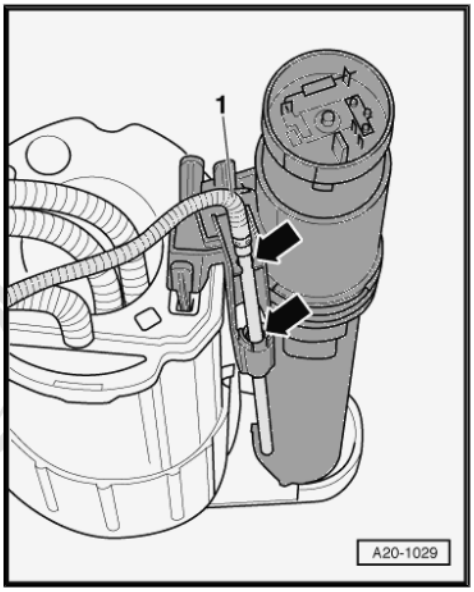
- Detach flange and remove seal.
- Detach electrical connectors -1 ... 4- at underside of flange.



Note

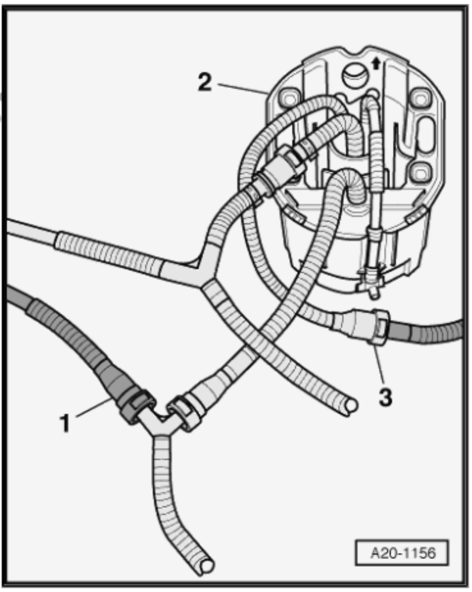
- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *Some of the components are shown removed in the following illustration.*

– Pull out suction pipe -1- for auxiliary heater from retainer -arrows- on tubular sender (right-side).



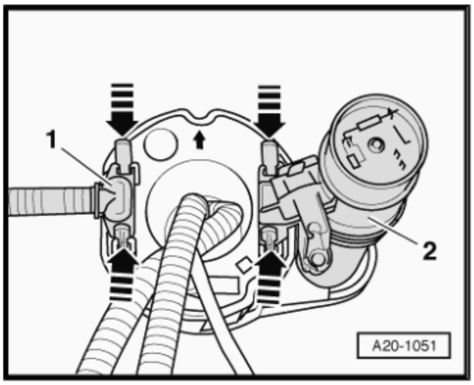
– Working through right fuel tank opening, press release tab and disconnect fuel lines -1- and -3-.

2 - Fuel delivery unit (right-side) with fuel pump - G23- .

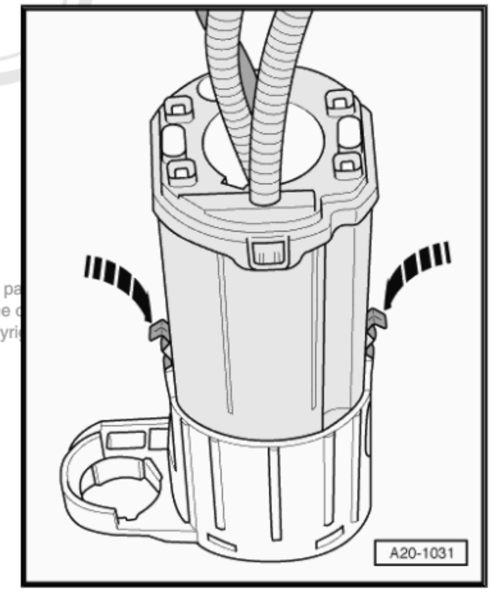


– Working through right fuel tank opening, press release tabs -arrows- and detach supply line -1- and fuel gauge sender 4 - G393- -item 2-.

– Move fuel gauge sender 4 - G393- to right side.



- Press down both retaining clips on retainer for fuel delivery unit (right-side) -arrows-.
- Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 4 - G393- .

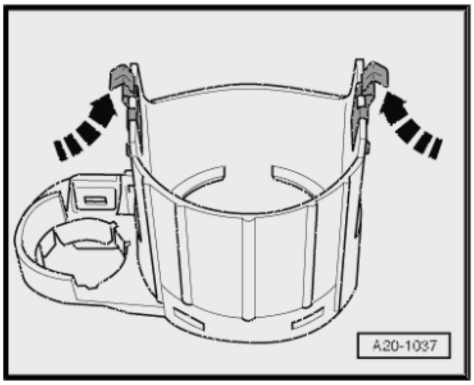


Note

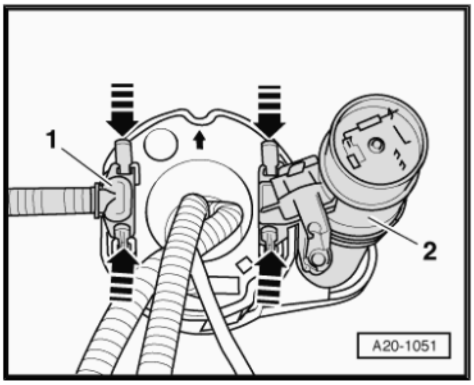
Keep in mind that the fuel gauge sender 4 - G393- still contains fuel.

Installing

- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing fuel delivery unit (right-side).
- Then press fuel delivery unit carefully into retainer so that it engages audibly.

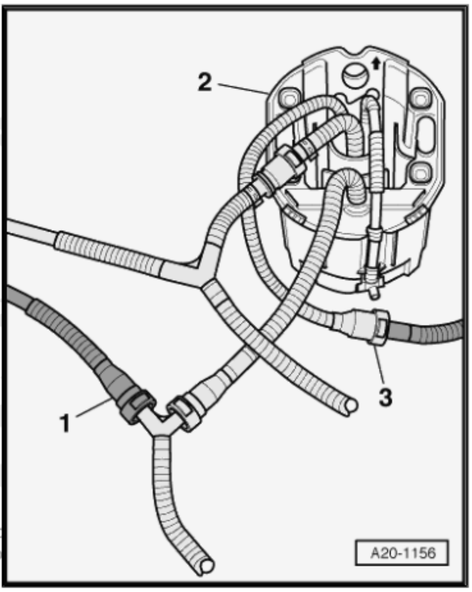


- Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly.

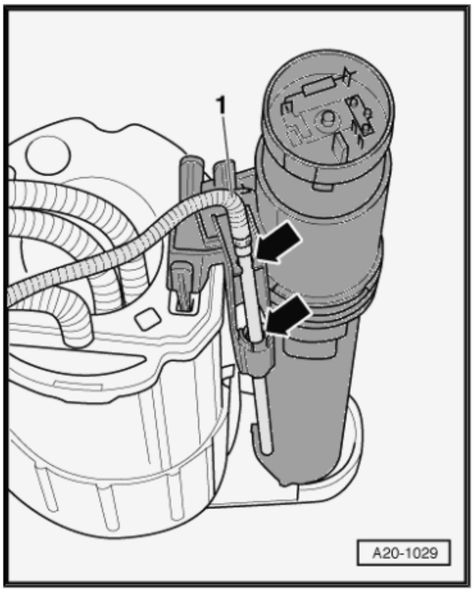


– Fit fuel lines -1- and -3- through right fuel tank opening so that they engage audibly.

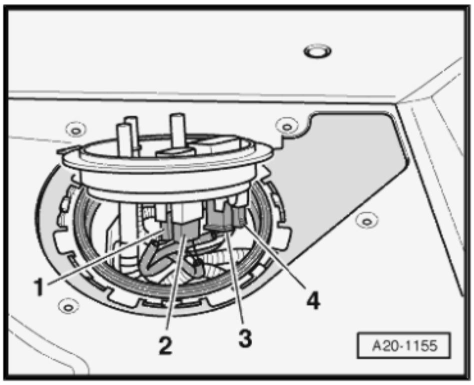
2 - Fuel delivery unit (right-side) with fuel pump - G23- .



– Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender (right-side).



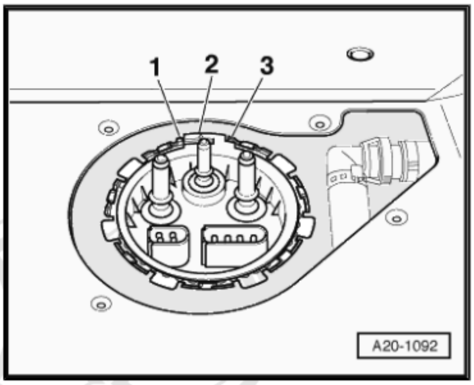
– Connect electrical connectors -1 ... 4- at underside of flange.



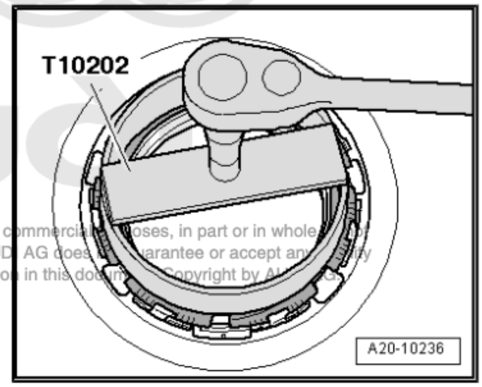
– Fit new seal for flange in fuel tank opening (seal should be dry).

– Fit flange (right-side) into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

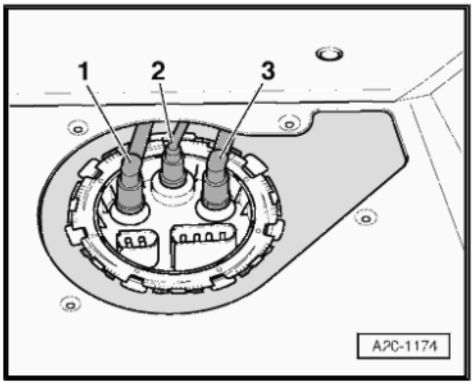


– Tighten locking ring.

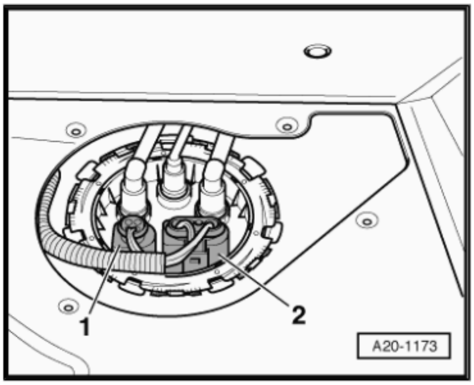


– Fit fuel return line -1- and fuel supply line -3- so that they engage audibly.

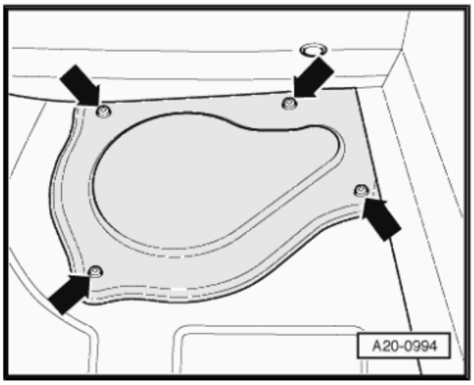
– Also fit supply line -2- going to auxiliary heater so that it engages audibly.



– Attach electrical connectors -1- and -2- at flange.



- Secure cover for flange -arrows-.



Tightening torque

Component	Nm
Locking ring for fuel delivery unit	120

3 Fuel cooler

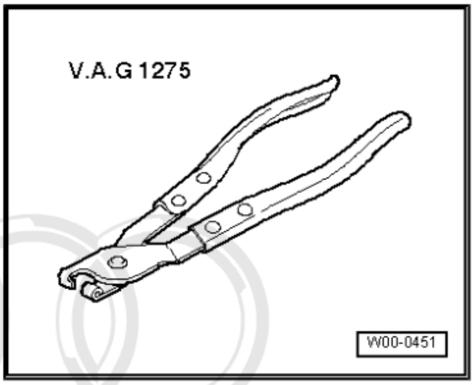
⇒ “3.1 Removing and installing fuel cooler on underbody”, page 63

⇒ “3.2 Removing and installing fuel cooler on engine - vehicles with 8-cylinder 4.0 ltr. TDI engine”, page 64

3.1 Removing and installing fuel cooler on underbody

Special tools and workshop equipment required

- Hose clip pliers - V.A.G 1275-

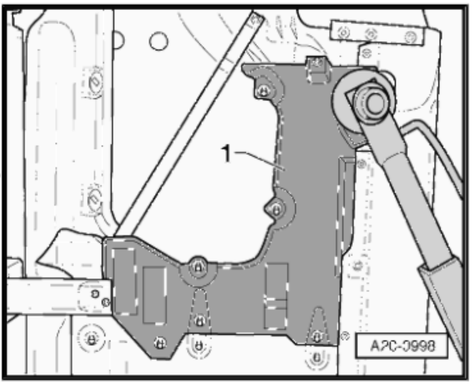


- Drip tray

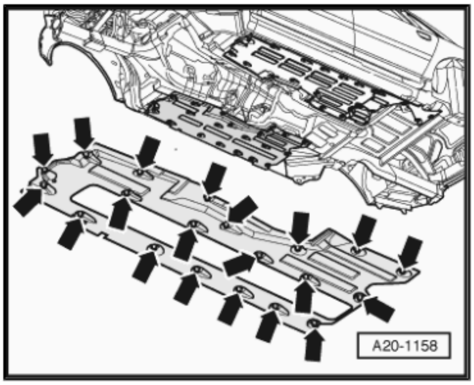
Removing

Observe rules for cleanliness ⇒ page 3 .

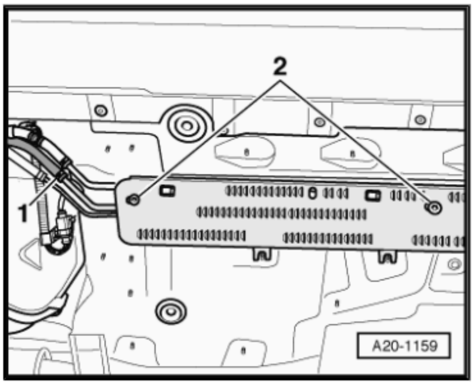
– Remove cover -1- on rear right side of fuel tank.



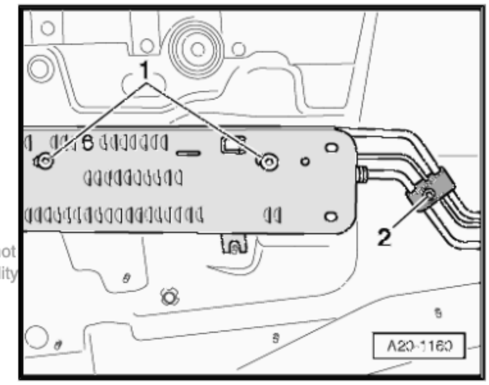
– Remove underbody cover (right-side) -arrows-.



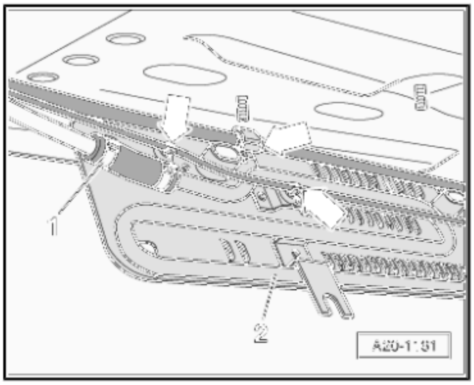
- Place drip tray below underbody.
- Disconnect fuel return line -1- from rear of fuel cooler and catch escaping fuel.
- Remove bolts -2-.



- Unscrew bolt -2- for the front bracket for the fuel lines.
- Remove bolts -1-.



- Move fuel cooler -2- to side and down and remove fuel return line -1- at front of fuel cooler.
- Unclip fuel supply lines -arrows- using a screwdriver and detach fuel cooler.



Installing

Installation is carried out in the reverse order; note the following:

Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.

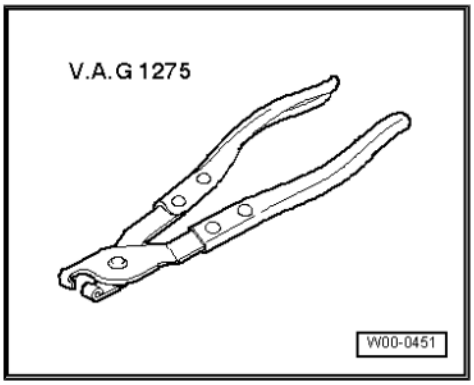
Tightening torques

Component	Nm
Fuel cooler to underbody	1.75
Cover to underbody	2.3

3.2 Removing and installing fuel cooler on engine - vehicles with 8-cylinder 4.0 ltr. TDI engine

Special tools and workshop equipment required

- ♦ Hose clip pliers - V.A.G 1275-



Removing

Observe rules for cleanliness ⇒ page 3 .

Note

The fuel cooler is located under the high-pressure pump (on the engine).

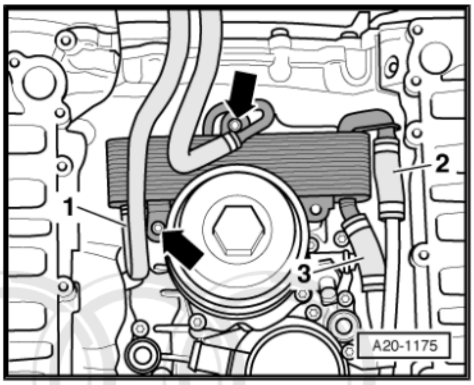
– Remove high-pressure pump with front bracket ⇒ Rep. gr. 13 .

– Disconnect fuel return hose -1- at fuel cooler.

– Detach coolant hoses -2- and -3- at fuel cooler.

– Remove bolts -arrows-.

– Remove fuel cooler.



Installing

Installation is carried out in the reverse order; note the following:

Note

- ♦ *Always renew seals and gaskets when assembling.*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

– Install high-pressure pump with front bracket ⇒ Rep. gr. 13 .

Tightening torque

Component	Nm
Fuel cooler to mounting plate	10

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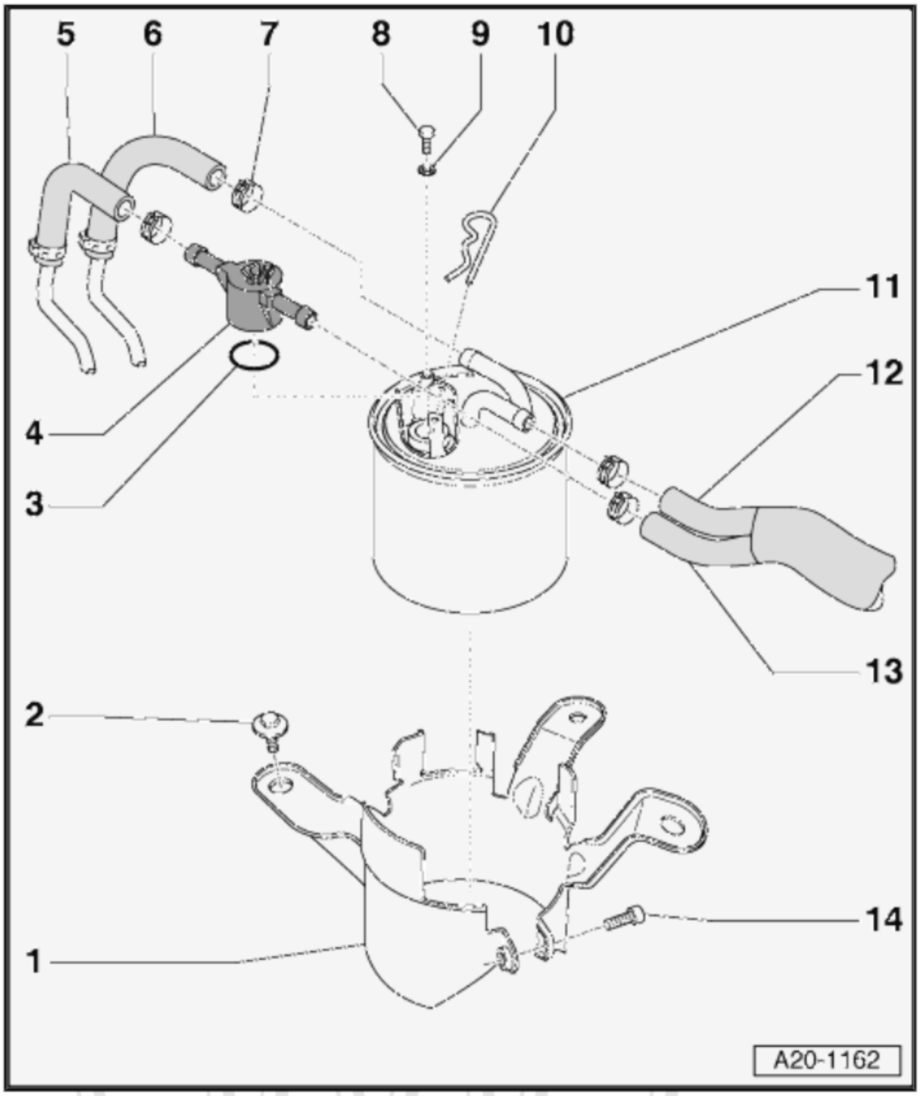
4 Servicing fuel filter

⇒ “4.1 Fuel filter - exploded view of components”, page 66

⇒ “4.2 Removing and installing fuel filter”, page 67

4.1 Fuel filter - exploded view of components



1 - Bracket
- ❑ For fuel filter

2 - 10 Nm

3 - O-ring
- ❑ Inserted in filter housing

4 - Regulating valve
- ❑ Installation position: arrow points towards fuel tank
- ❑ When changing filter, remove retaining clip and take regulating valve off with fuel lines connected
- ❑ Make sure O-ring in filter housing is in correct position when fitting regulating valve
- ❑ Temperatures below approx. 60 °C: Passage to filter open
- ❑ Temperatures above approx. 70 °C: Passage to filter closed

5 - Return line
- ❑ To fuel cooler
- ❑ Blue marking

6 - Supply line
- ❑ From fuel tank
- ❑ White marking

7 - Spring-type clip

8 - Bleeder screw, 4 Nm

9 - Seal
- ❑ Renew

10 - Retaining clip
- ❑ Renew after removing

11 - Fuel filter
- ❑ Flow direction is marked by arrows
- ❑ Do not interchange connections
- ❑ Renew filter at intervals specified in Service Schedule ⇒ Maintenance ; Booklet 404
- ❑ With seal for regulating valve

12 - Supply line
- ❑ To high-pressure pump
- ❑ White marking

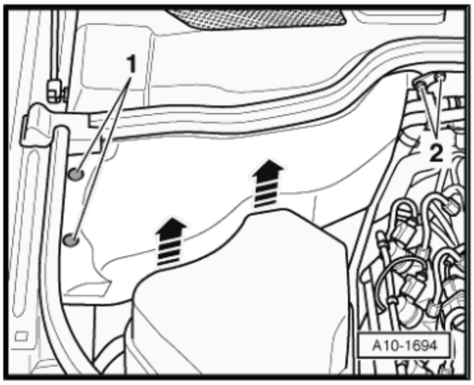
13 - Return line
- ❑ From engine
- ❑ Blue marking

14 - 10 Nm

4.2 Removing and installing fuel filter

Removing

Observe rules for cleanliness ⇒ page 3 .

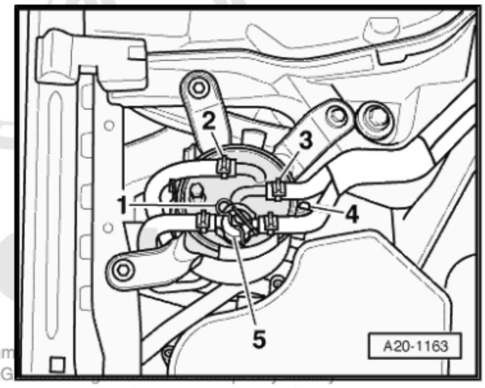


Note

- ♦ *Fitting location of fuel filter: at rear right of engine compartment.*
- ♦ *Please ensure that no diesel fuel contacts coolant hoses. If necessary clean hoses immediately.*
- ♦ *Please observe requirements for disposal.*

– If fitted, remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew bolted joint -2-.

– Pull cover out of retainers -arrows-.



– Detach retaining clip -1-.

– Detach regulating valve -5- with fuel pipes still connected.

– Disconnect fuel hoses -2- and -3- from hose connections.

– Slacken clamping bolt -4- at bracket and remove fuel filter from bracket.

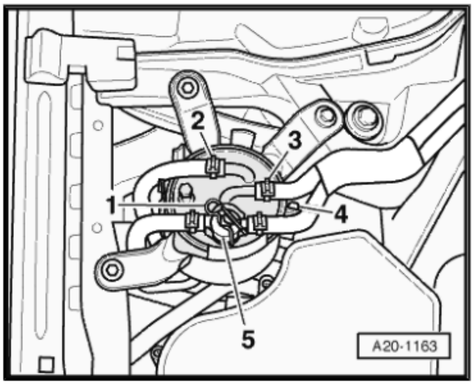
Installing

Installation is carried out in the reverse order; note the following:

Note

- ♦ *Always renew seals, retaining clips and gaskets when assembling.*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Fill new filter with clean diesel fuel. This will enable the engine to start more quickly.



– Fit fuel filter in bracket and tighten clamping bolt -4- to 10 Nm.

– Make sure O-ring in filter housing is in correct position when fitting regulating valve -5-.

– Install regulating valve with fuel lines connected.

– Attach retaining clip -1-.

– Push fuel hoses -2- and -3- onto hose connections and secure with hose clips.

5 Bleeding fuel system

Due to the design of the engine, with a fuel system pressurisation pump located in the fuel tank, it is not necessary to bleed the fuel system.

The fuel system bleeds itself when the starter is operated.

6 Checking fuel system for leaks

⇒ “6.1 Checking fuel system for leaks (vehicles with 6-cyl. TDI engine)”, page 69

⇒ “6.2 Checking fuel system for leaks (vehicles with 8-cyl. 4.0 ltr. TDI engine)”, page 70

⇒ “6.3 Checking fuel system for leaks (vehicles with 8-cyl. 4.2 ltr. TDI engine)”, page 72

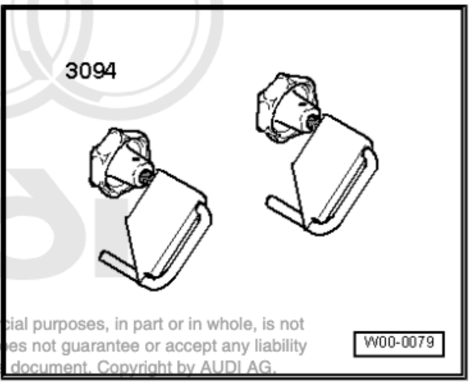
6.1 Checking fuel system for leaks (vehicles with 6-cyl. TDI engine)

A leaking fuel system can cause:

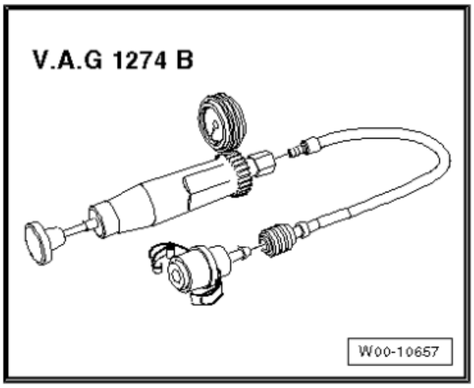
- Foam build-up or air bubbles in the supply line
- Lack of power, misfiring
- Starting problems

Special tools and workshop equipment required

- Hose clamps, up to 25 mm - 3094-

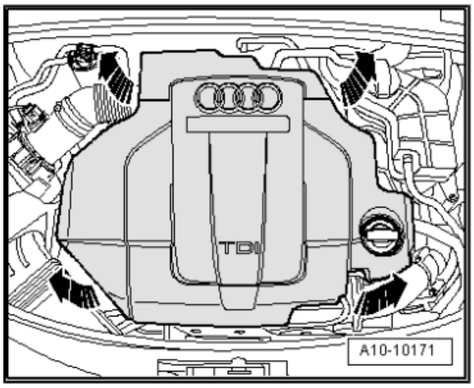


- Cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/1 A- and adapter for testing diesel fuel - V.A.G 1274/2-

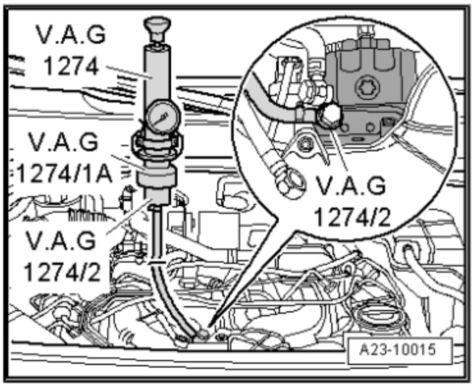


Procedure

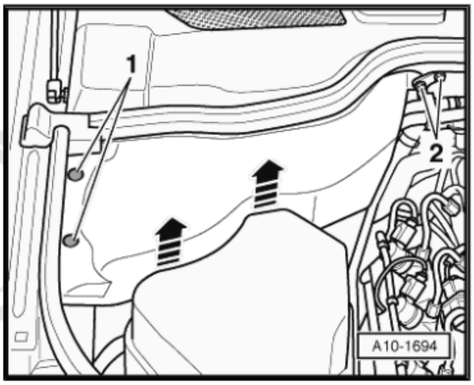
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



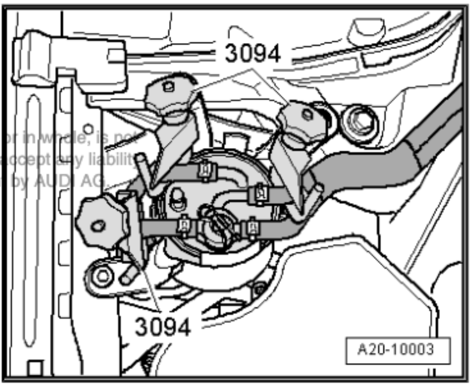
- Attach adapter - V.A.G 1274/2- with adapter - V.A.G 1274/1A- to coolant system tester - V.A.G 1274 B- .
- Unscrew fuel supply line at high-pressure pump and connect up hose of adapter - V.A.G 1274/2- in its place.



- If fitted, remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- Pull cover out of retainers -arrows-.



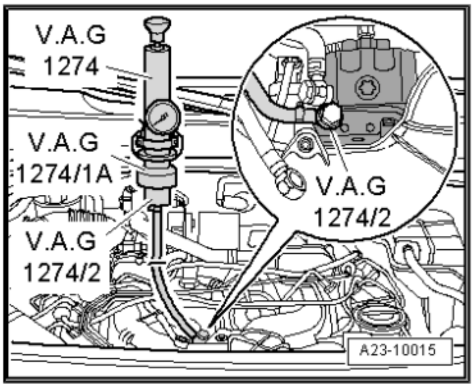
- Fit hose clamps - 3094- at the following points:
- Supply line upstream of fuel filter.
- Supply line to high-pressure pump.
- Return line to fuel tank.



- Use cooling system tester - V.A.G 1274 B- to create a pressure of between 1.0 ... 1.5 bar.
- If pressure drops constantly, locate leak and eliminate fault.

Note

By moving the hose clamps from the filter to the fuel tank connections it is also possible to check the fuel hoses at the same time.



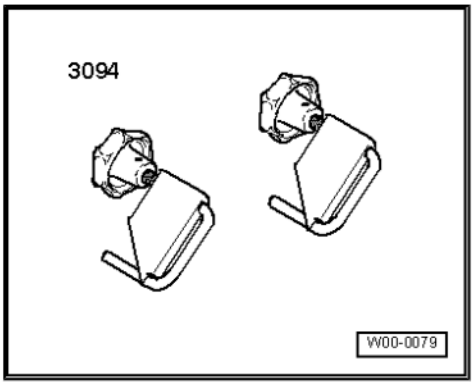
6.2 Checking fuel system for leaks (vehicles with 8-cyl. 4.0 ltr. TDI engine)

A leaking fuel system can cause:

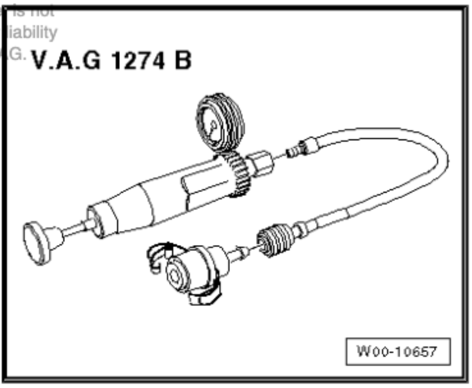
- Foam build-up or air bubbles in the supply line
- Lack of power, misfiring
- Starting problems

Special tools and workshop equipment required

- Hose clamps, up to 25 mm - 3094-

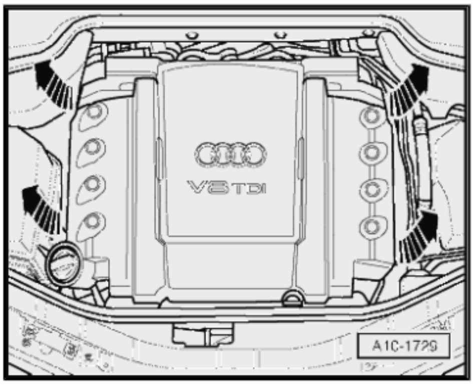


- Cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/1 A- and adapter for testing diesel fuel - V.A.G 1274/2-



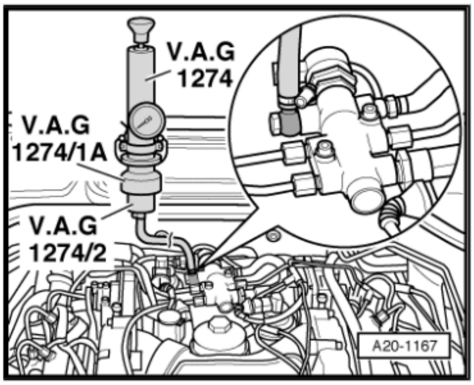
Procedure

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.

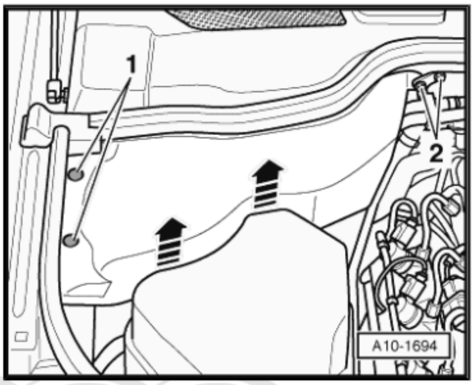


– Attach adapter - V.A.G 1274/2- with adapter - V.A.G 1274/1A- to coolant system tester - V.A.G 1274 B- .

– Unscrew fuel return line at fuel rail and connect up hose of adapter - V.A.G 1274/2- in its place.

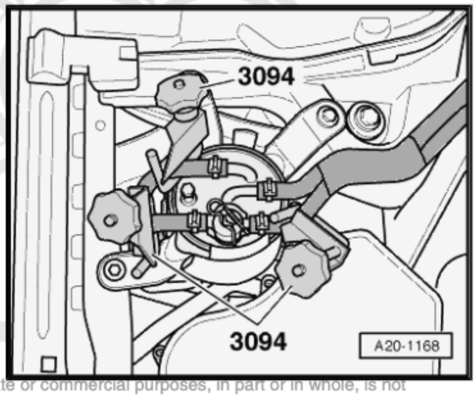


- If fitted, remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- Pull cover out of retainers -arrows-.



- Fit hose clamps - 3094- at the following points:

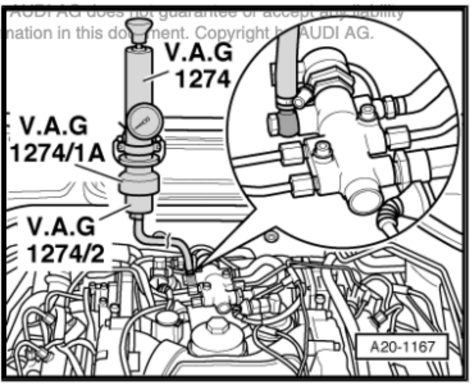
- Supply line upstream of fuel filter.
- Return line to fuel tank.
- Return line from fuel cooler on engine.



- Use cooling system tester - V.A.G 1274 B- to create a pressure of between 1.0 ... 1.5 bar.
- If pressure drops constantly, locate leak and eliminate fault.

Note

By moving the hose clamps from the filter to the fuel tank connections it is also possible to check the fuel hoses at the same time.



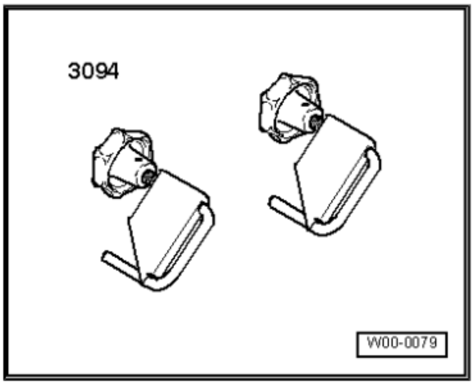
6.3 Checking fuel system for leaks (vehicles with 8-cyl. 4.2 ltr. TDI engine)

A leaking fuel system can cause:

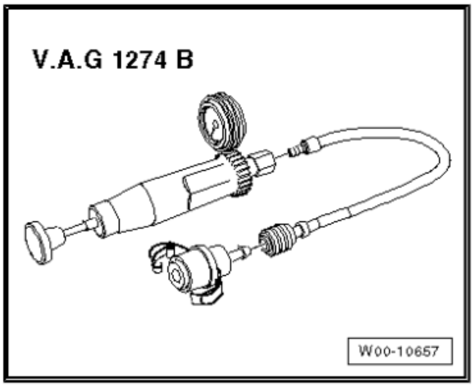
- ♦ Foam build-up or air bubbles in the supply line
- ♦ Lack of power, misfiring
- ♦ Starting problems

Special tools and workshop equipment required

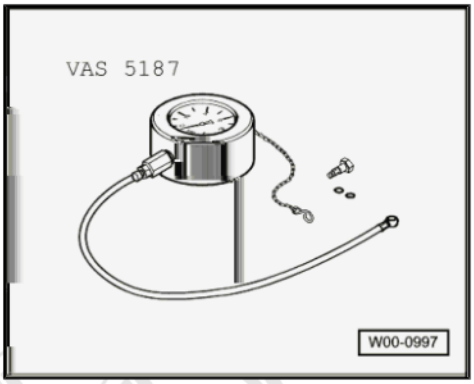
- Hose clamps, up to 25 mm - 3094-



- Cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/1 A- and adapter for testing diesel fuel - V.A.G 1274/2-

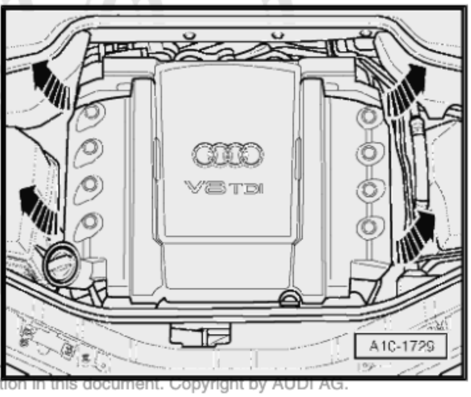


- Tandem pump tester - VAS 5187-

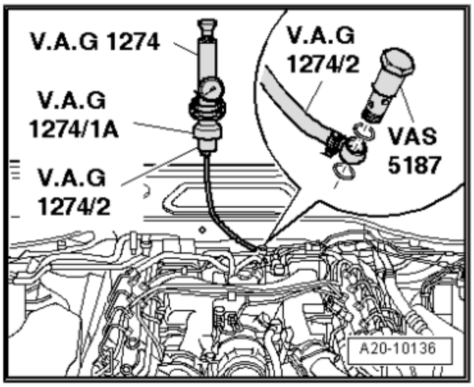


Procedure

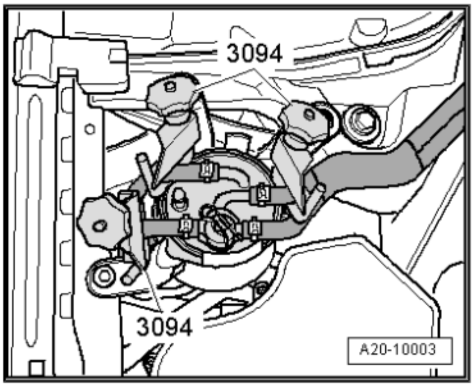
– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



- Attach adapter - V.A.G 1274/2- with adapter - V.A.G 1274/1A- to coolant system tester - V.A.G 1274 B- .
- Unscrew fuel supply line at high-pressure pump and in its place connect up hose of adapter - V.A.G 1274/2- using banjo bolt from -VAS 5187- to high-pressure pump.



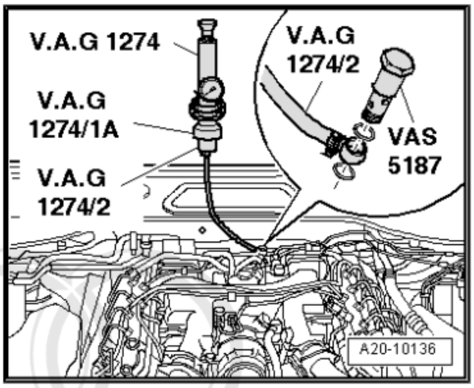
- Fit hose clamps - 3094- at the following points:
- Supply line upstream of fuel filter.
- Supply line to high-pressure pump.
- Return line to fuel tank.



- Use cooling system tester - V.A.G 1274 B- to create a pressure of between 1.0 ... 1.5 bar.
- If pressure drops constantly, locate leak and eliminate fault.

Note

By moving the hose clamps from the filter to the fuel tank connections it is also possible to check the fuel hoses at the same time.



7 Servicing accelerator mechanism

⇒ “7.1 Accelerator mechanism - exploded view of components”, page 75

⇒ “7.2 Removing and installing accelerator pedal module with accelerator position sender”, page 76

⇒ “7.3 Checking kickdown switch F8 ”, page 76

⇒ “7.4 Removing and installing kickdown switch F8 ”, page 77

7.1 Accelerator mechanism - exploded view of components

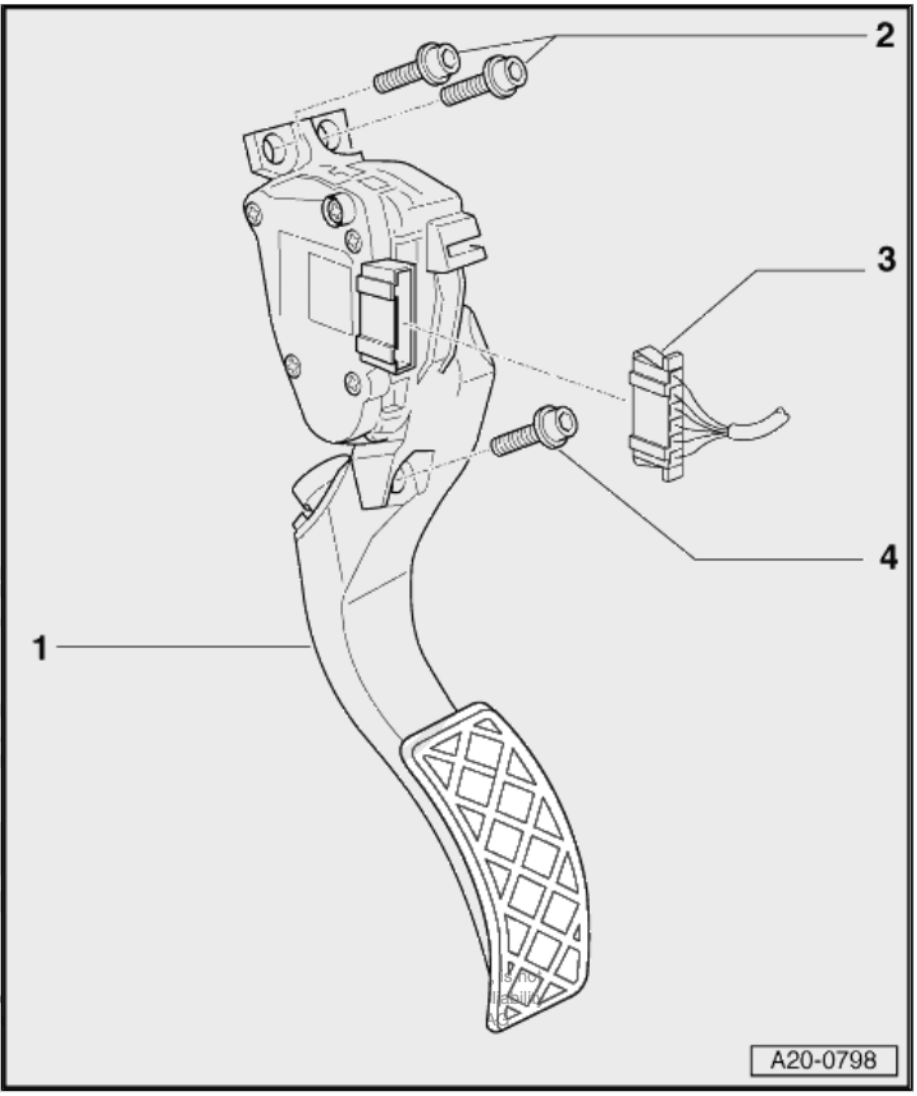
1 - Accelerator pedal module

- ❑ With accelerator position sender - G79- and accelerator position sender 2 - G185-
- ❑ Removing and installing ⇒ page 76

2 - 10 Nm

3 - Electrical connector

4 - 10 Nm



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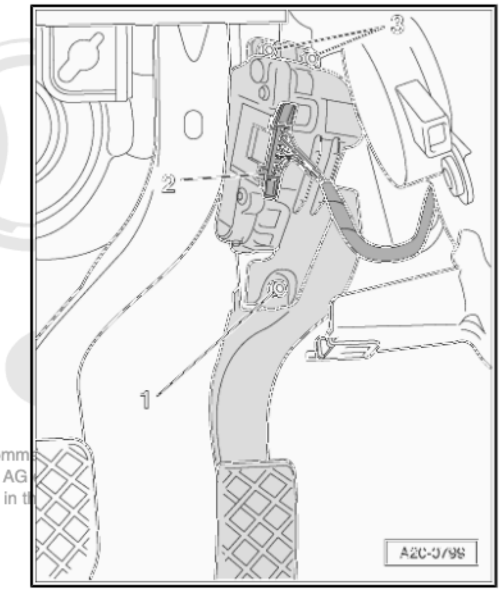
7.2 Removing and installing accelerator pedal module with accelerator position sender



Removing

- Remove storage compartment on driver's side ⇒ Rep. gr. 68 .
- Unplug electrical connector -2-.
- Remove bolts -1- and -3-.
- Remove accelerator pedal module.

Installing

Installation is carried out in the reverse order; note the following:

- Install storage compartment on driver's side ⇒ Rep. gr. 68 .

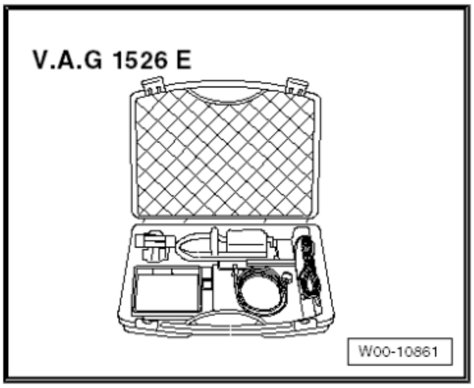
Tightening torque

Component	Nm
Accelerator pedal module to pedal bracket	10

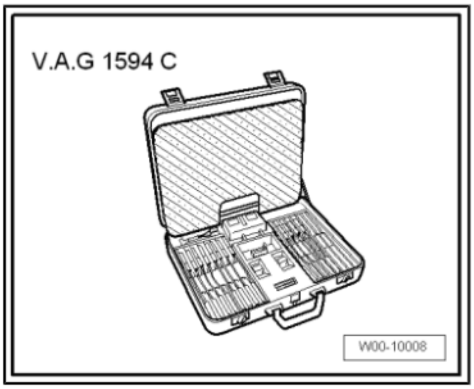
7.3 Checking kickdown switch - F8-

Special tools and workshop equipment required

- ♦ Vehicle diagnostic tester
- ♦ Hand-held multimeter - V.A.G 1526 E-



- ♦ Auxiliary measuring set - V.A.G 1594 C-



Test conditions

- Vehicle diagnostic tester connected.
- No faults stored in fault memory.

- Engine stopped, ignition switched on

Test sequence

– Select the following menu items in `Guided Functions` mode of vehicle diagnostic tester :

◆ `02-Gearbox electronics`

◆ `02-Read measured values`

– Select display group 8 (kickdown switch) from the list ⇒ Vehicle diagnostic tester.

- Accelerator not depressed: display remains blank

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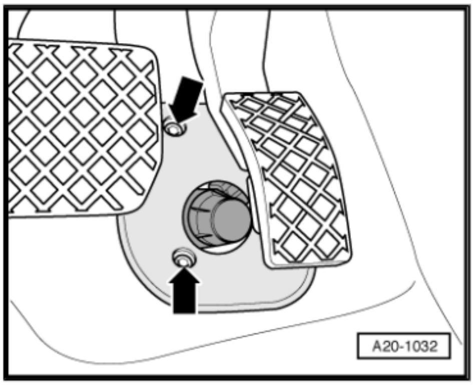
permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability
with...

– Fully depress accelerator pedal beyond kickdown point and keep it pressed.

- Indicated on display: “kick-down”.

If display differs from specification described above:



– Use screwdriver to prise off cover caps.

– Unscrew bolts -arrows- and remove cover for kickdown switch.

– Unplug electrical connector.

– Connect hand-held multimeter - V.A.G 1526 E- to kickdown switch - F8- to measure resistance.

- Specification: ∞ Ω (no continuity)

– Fully depress accelerator pedal beyond kickdown point and keep it pressed.

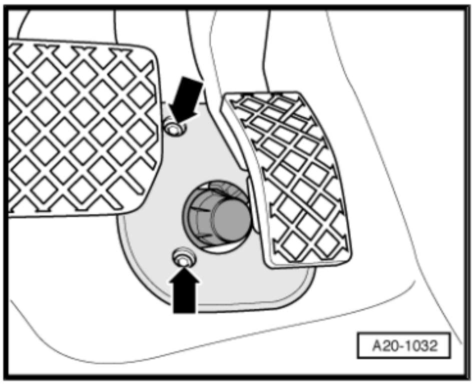
- Specification: 0 Ω (continuity)

If display differs from specification described above:

– Renew kickdown switch - F8- ⇒ page 77 .

7.4 Removing and installing kickdown switch - F8-

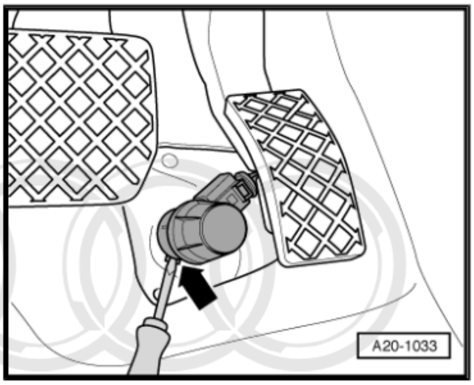
Removing



– Use screwdriver to prise off cover caps.

– Unscrew bolts -arrows- and remove cover for kickdown switch - F8- .

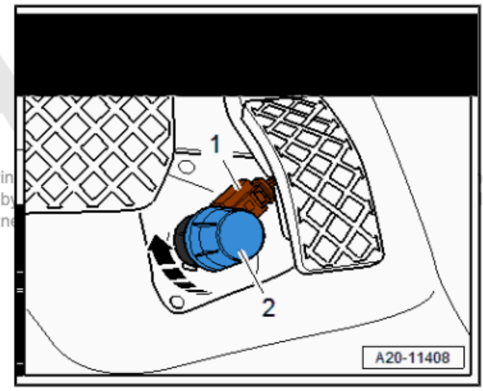
- Use a small screwdriver to release retainer tab -arrow- and turn kickdown switch - F8- anti-clockwise.
- Unplug electrical connector.



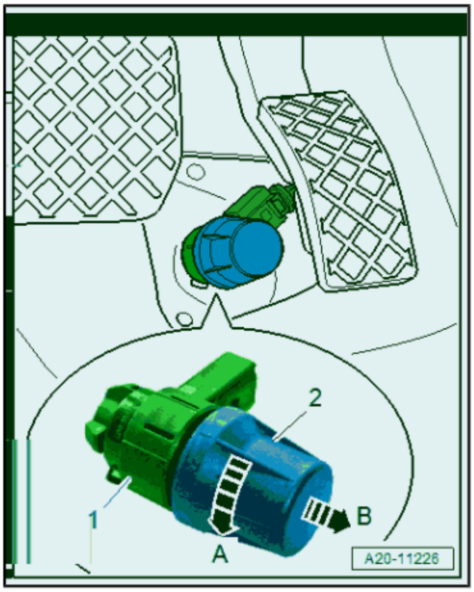
Installing

Installation is carried out in the reverse order; note the following:

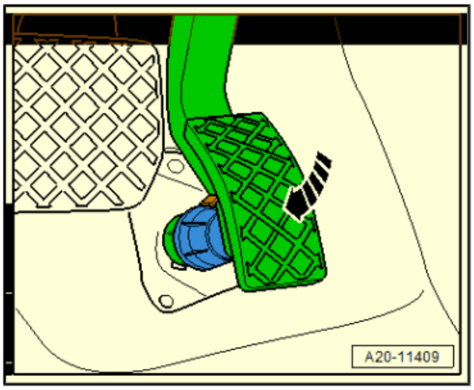
- Connect electrical connector -1- on kickdown switch - F8- .
- Insert kickdown switch in mounting on vehicle floor and engage by turning clockwise -arrow-.



- Disengage cap -2- of kickdown switch -1-; to do so turn cap anti-clockwise -arrow A-. Pull cap out as far as stop -arrow B-.

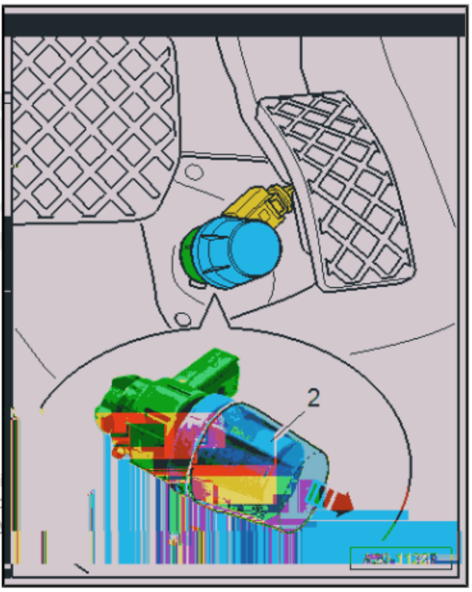


- Press accelerator pedal down as far as stop -arrow- and release again.

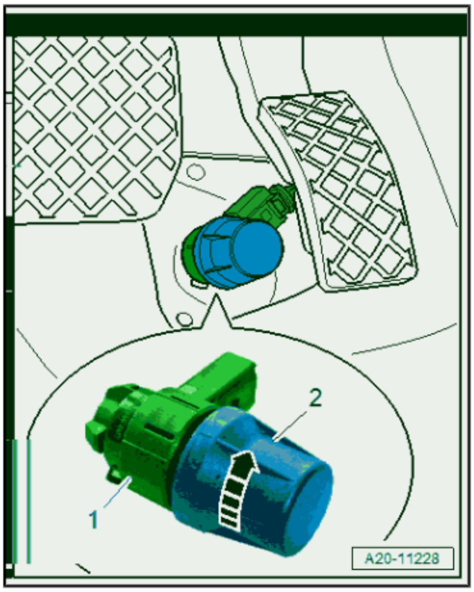


- Pull cap -2- of kickdown switch -1- outwards by distance -a- -arrow-.

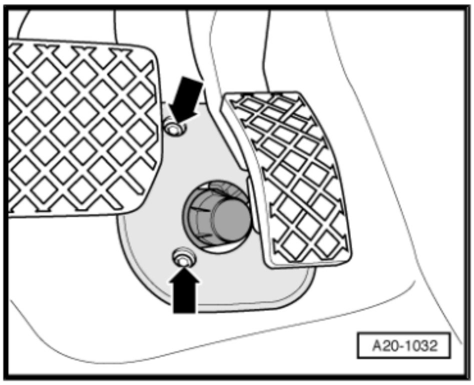
- Distance -a- = 5 mm.



- Lock cap -2- of kickdown switch -1- in its end position by turning it 15° in clockwise direction -arrow-.
- Check kickdown switch - F8- ⇒ page 76 .



- Fit cover -arrows-.



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1.1 Removing and installing glow plugs 103

1 Servicing diesel direct injection system

(ARL003647; Edition 11.2013)

1.1 Safety precautions

Note the following if testers and measuring instruments have to be used during a road test:

WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Injuries can also be caused if the passenger's airbag is triggered in a collision.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*

◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

Caution

◆ *Observe notes on procedure for disconnecting the battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .*

1.2 To avoid any risk of injuries to persons and/or damage to the injection and glow plug system, always observe the following safety precautions:

◆ Persons wearing a pacemaker should not lean over the engine compartment while the engine is running, as the injectors use high voltage pulses.

◆ Do not open any fuel line connections while the engine is running.

◆ Always switch off the ignition before connecting or disconnecting injection and glow plug system wiring or tester cables.

◆ Always switch off the ignition before cleaning the engine.

◆ Certain tests may lead to a fault being detected by the control unit and stored. The fault memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.

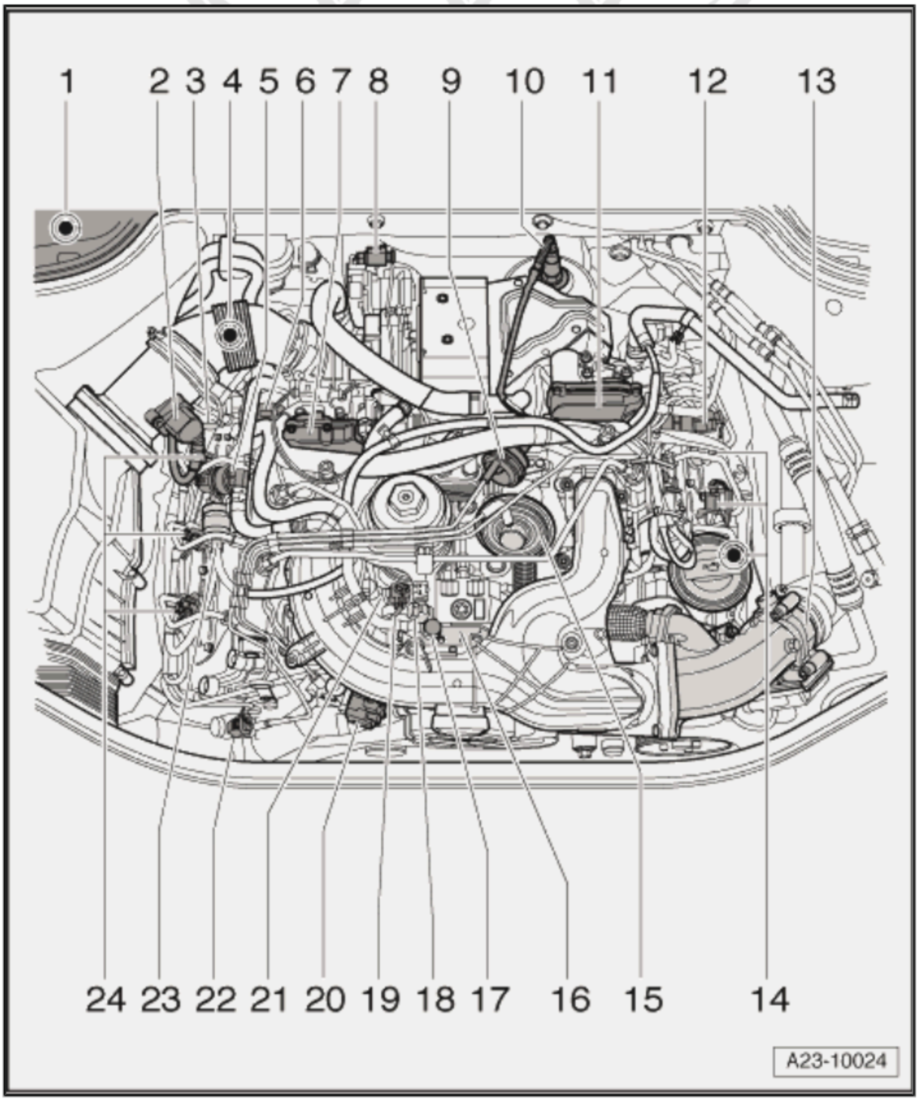
1.3 Rules for cleanliness and instructions for working on fuel system

- Clean tools and workbench etc. before working on the injection system.
- Thoroughly clean all unions and surrounding areas before disconnecting.
- When removing components, plug all open connections immediately with suitable clean sealing caps.
- Do not remove sealing caps from components until immediately prior to installation. After removal, components should be kept in new, sealable plastic bags (use the original new part packaging if possible).
- Before installation, check the injectors and their surroundings visually; they must be undamaged and free of lint. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- If components are not being renewed, always mark the high-pressure fuel lines on removal. High-pressure fuel lines must always be re-installed in their original positions (i.e. on the same cylinder).
- The following components and seals/O-rings must always be renewed when the injectors are removed and installed: “copper seal”, “O-ring for injector bore”, “O-ring for injector return connection”.
- The following components and seals/O-rings must always be renewed when an injector is renewed: “clamping piece”, “copper seal”, “O-ring for injector bore”, “O-ring for injector return connection”.
- Always fit new copper seals for the injectors. Check all new O-rings for damage before installing. Lubricate O-rings lightly with assembly oil or clean engine oil before installing. Use assembly tool for installing the “O-ring for injector return connection”.
- Take care not to damage the injectors when removing the old copper seals.
- Align the high-pressure fuel lines so they are free of tension. Tighten all unions lightly to start with before tightening to final torque.
- Never attempt to bend high-pressure fuel lines to shape.
- When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- Press the return lines onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Check that the return lines are seated securely by pulling them by hand from above. Also check that they seal properly (fuel pressure in return line as far as pressure retention valve: between 8 and 10 bar).
- All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- When the fuel system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.

- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

1.4 Overview of fitting locations

Components A to M are not shown in the illustration.



1 - Electronics box in plenum chamber

- ❑ Diesel direct injection system control unit - J248- with altitude sensor
- ❑ Removing and installing ⇒ page 88
- ❑ Fitting location of automatic glow period control unit - J179- ⇒ page 6
- ❑ Fitting location of terminal 30 voltage supply relay - J317- ⇒ page 6

2 - Air mass meter - G70-

- ❑ Removing and installing ⇒ page 18

3 - Hall sender - G40- (camshaft position sensor)

4 - Coolant temperature sender - G62-

- ❑ Fitting location ⇒ page 8
- ❑ Removing and installing ⇒ Rep. gr. 19

5 - Fuel temperature sender - G81-

6 - Fuel pressure regulating valve - N276-

- ❑ Removing and installing

⇒ page 94

7 - Intake manifold flap motor - V157-

- ☐ Cylinder bank 1
- ☐ Removing and installing ⇒ page 35
- ☐ Exploded view - intake manifold ⇒ page 18

8 - Control unit for turbocharger 1 - J724-

9 - Vacuum unit

- ☐ For change-over flap for exhaust gas recirculation cooler

10 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Removing and installing ⇒ page 99

11 - Intake manifold flap 2 motor - V275-

- ☐ Cylinder bank 2
- ☐ Removing and installing ⇒ page 35
- ☐ Exploded view - intake manifold ⇒ page 18

12 - Fuel pressure sender - G247-

- ☐ Removing and installing ⇒ page 98

13 - Throttle valve module - J338-

14 - Injectors (piezo injectors)

- ☐ Cylinder bank 2
- ☐ Removing and installing ⇒ page 52

15 - Mechanical exhaust gas recirculation valve

- ☐ Overview of exhaust gas recirculation system ⇒ Rep. gr. 26
- ☐ Removing and installing ⇒ Rep. gr. 26

16 - High-pressure fuel pump

- ☐ With gear-type fuel system pressurisation pump
- ☐ High-pressure pump generates fuel pressure up to 1600 bar
- ☐ Gear-type fuel system pressurisation pump generates fuel pressure between 4 and 5 bar
- ☐ Overview: vehicles up to 08.2005 ⇒ page 69 ; vehicles from 08.2005 onwards ⇒ page 76
- ☐ Removing and installing: vehicles up to 08.2005 ⇒ “1.28 Removing and installing high-pressure pump - vehicles up to 08.2005”, page 72 ; vehicles from 08.2005 onwards ⇒ page 79

17 - Fuel supply line connection

18 - Fuel return line connection

19 - Fuel metering valve - N290-

20 - Exhaust gas recirculation valve - N18-

- ☐ Fitting location ⇒ page 8

21 - Oil pressure switch - F1-

- ☐ Fitting location ⇒ page 8
- ☐ Checking ⇒ Rep. gr. 17

22 - Exhaust gas recirculation cooler change-over valve - N345-

- ☐ Overview of exhaust gas recirculation system ⇒ Rep. gr. 26

23 - Pressure retention valve

- ☐ In return lines from cylinder banks 1 and 2
- ☐ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines.
- ☐ This residual pressure is required for the control function of the piezo injectors.
- ☐ The pressure retention valve may only be renewed together with the fuel return lines.
- ☐ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system

24 - Injectors (piezo injectors)

- ☐ Cylinder bank 1
- ☐ Removing and installing ⇒ page 52

A - Brake light switch - F- and brake pedal switch for cruise control system (diesel direct-injection system) - F47-

- ☐ In footwell on brake pedal

B - Accelerator position sender - G79-

- ☐ In footwell on accelerator pedal
- ☐ Fitting location ⇒ page 6

C - Fuel pump relay - J17-

- ☐ Relay and fuse holder in luggage compartment (right-side)
- ☐ Fitting location ⇒ page 7

D - Charge pressure sender - G31-

- ☐ With intake air temperature sender - G42-
- ☐ In charge air cooler (left-side) ⇒ page 7
- ☐ Removing and installing ⇒ Rep. gr. 21

E - Starter motor relay - J53- and starter motor relay 2 - J695-

- ☐ Relay and fuse holder in front footwell (right-side)
- ☐ Fitting location ⇒ page 7

F - Engine speed sender -G28-

- ☐ Fitting location ⇒ page 8

G - Automatic glow period control unit - J179-

- ☐ Relay and fuse holder in electronics box, plenum chamber
- ☐ Fitting location ⇒ page 6

H - Air cleaner bypass flap valve - N275-

- ☐ These components (bypass flap with air cleaner bypass flap valve - N275-) are not installed on certain equipment versions or on vehicles for certain export markets
- ☐ If fitted, the bypass flap is located in the air cleaner housing and the air cleaner bypass flap valve - N275- is located on the outside of the air cleaner housing

I - Exhaust gas pressure sensor 1 - G450-

- ☐ Only fitted on vehicles with particulate filter
- ☐ Exhaust gas pressure sensor 1 - G450- is mounted on gearbox (right-side in direction of travel)
- ☐ Removing and installing ⇒ page 101

Adaption must be performed after renewing exhaust gas pressure sensor 1 - G450- and/or particulate filter. (The procedure is described under Guided Functions.)

- – Enter correct vehicle identification in Guided Fault Finding.
- – Press “Go to” button.
- – Press “Function/component selection”.
- – Select “Drive train”.
- – “01 - Self-diagnosis compatible systems”
- – “01 - Engine electronics”
- – Select “Functions”.
- – “J248 Adapt particulate filter learned values”

J - Exhaust gas temperature sender 1 - G235-

- ❑ On turbocharger ⇒ page 9
- ❑ Removing and installing ⇒ Rep. gr. 26

K - Exhaust gas temperature sender 2 - G448-

- ❑ Only fitted on vehicles with particulate filter
- ❑ Located downstream of starter catalytic converter ⇒ page 9
- ❑ Removing and installing ⇒ Rep. gr. 26

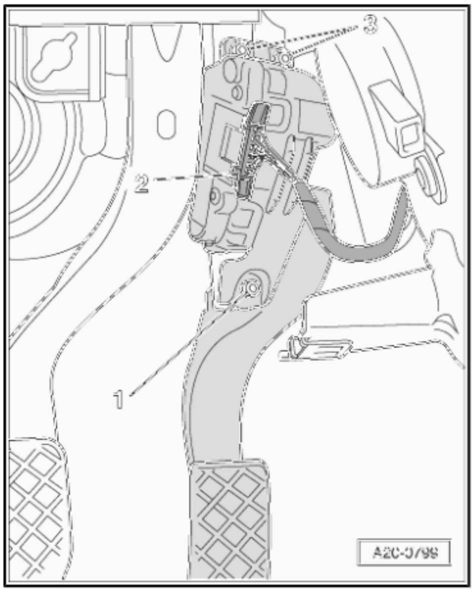
L - Temperature sender before particulate filter - G506-

- ❑ Only fitted on vehicles with particulate filter
- ❑ Located between main catalytic converter and particulate filter
- ❑ Removing and installing ⇒ Rep. gr. 26

M - Particulate filter

- ❑ Fitted on vehicle underbody
- ❑ Combined as one component with main catalytic converter (located upstream)
- ❑ Adaption must be performed after renewing this component
- ❑ Removing and installing ⇒ Rep. gr. 26

Accelerator position sender - G79-

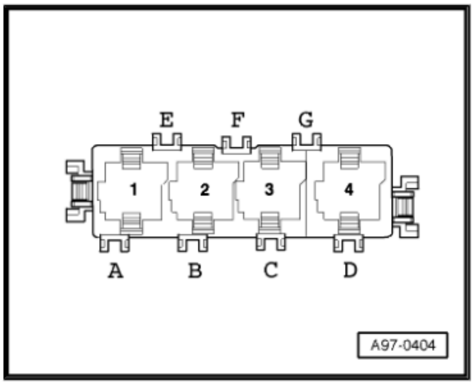


Relay and fuse holder in electronics box, plenum chamber

2 - Terminal 30 voltage supply relay - J317-

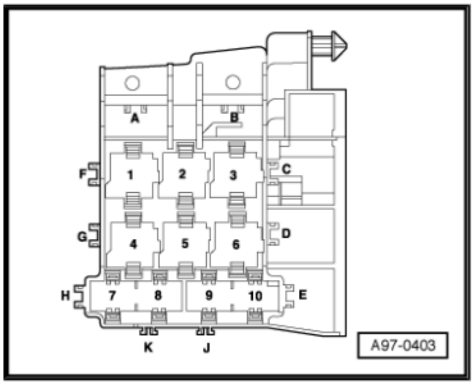
3 - Automatic glow period control unit - J179-

B - Glow plug fuse



Relay and fuse holder behind dash panel (left-side)

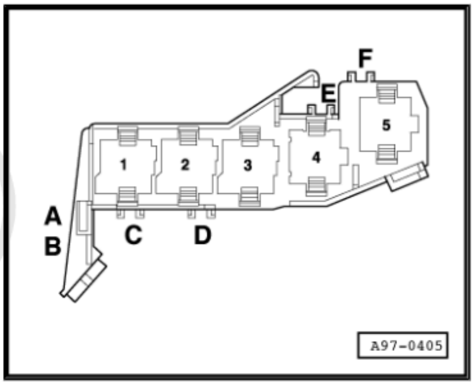
3 - Terminal 15 voltage supply relay - J329-



Relay carrier in passenger's footwell

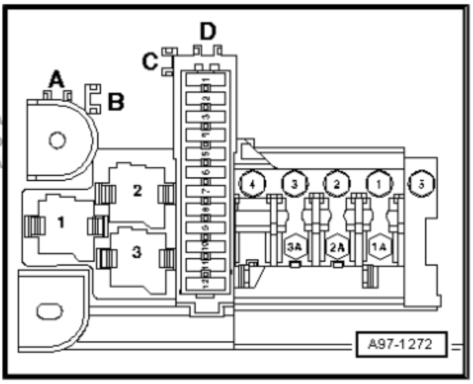
2 - Starter motor relay - J53-

3 - Starter motor relay 2 - J695-



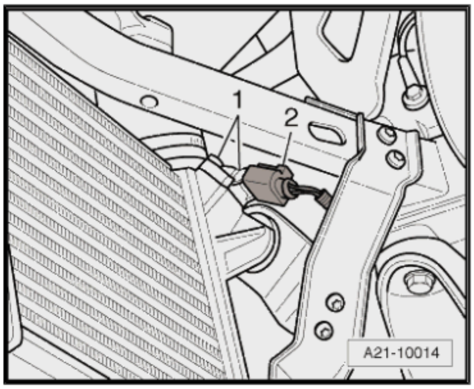
Relay and fuse holder in luggage compartment (right-side)

3 - Fuel pump relay - J17-



Charge pressure sender - G31- with intake air temperature sender - G42-

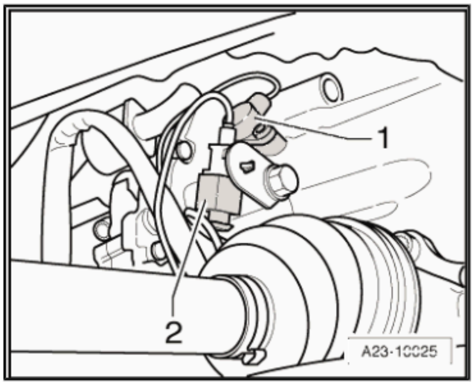
- Removing and installing ⇒ Rep. gr. 21



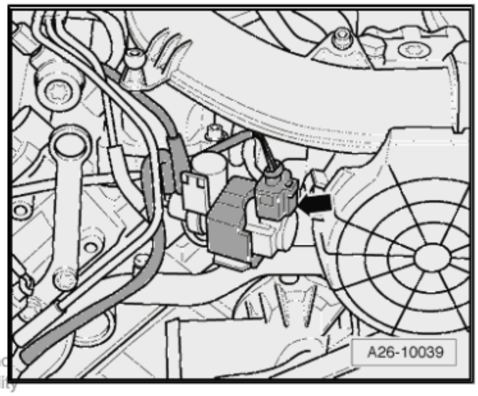
Engine speed sender - G28-

1 - Engine speed sender - G28-

2 - 3-pin connector



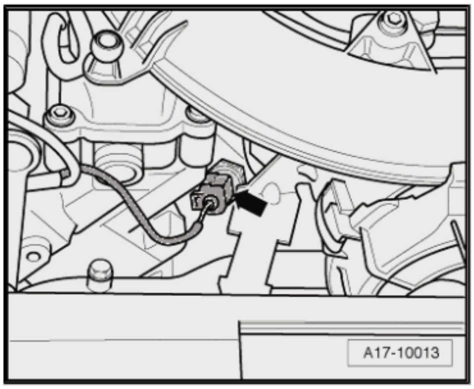
Exhaust gas recirculation valve - N18- -arrow-



Oil pressure switch - F1- -arrow-

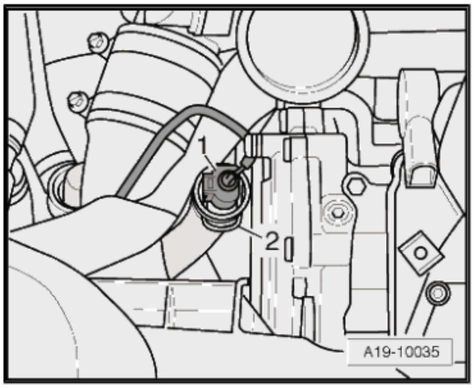
Removing and installing ⇒ Rep. gr. 17

Checking ⇒ Rep. gr. 17



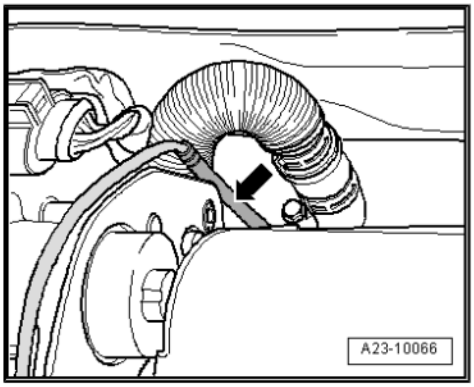
Coolant temperature sender - G62-

Removing and installing ⇒ Rep. gr. 19



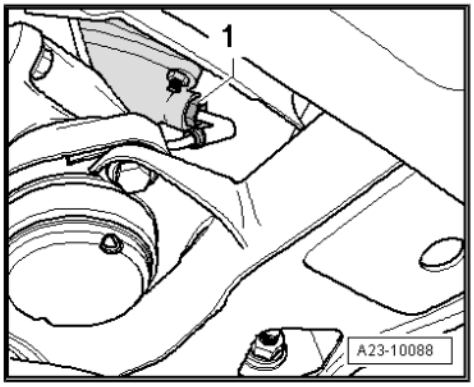
Exhaust gas temperature sender 1 - G235- -arrow-

Removing and installing ⇒ Rep. gr. 26



Exhaust gas temperature sender 2 for cylinder bank 1 - G448- -1-

Removing and installing ⇒ Rep. gr. 26



1.5 System layout

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

1 - Fuel metering valve - N290-

- ❑ Do not unscrew

2 - High-pressure fuel pump

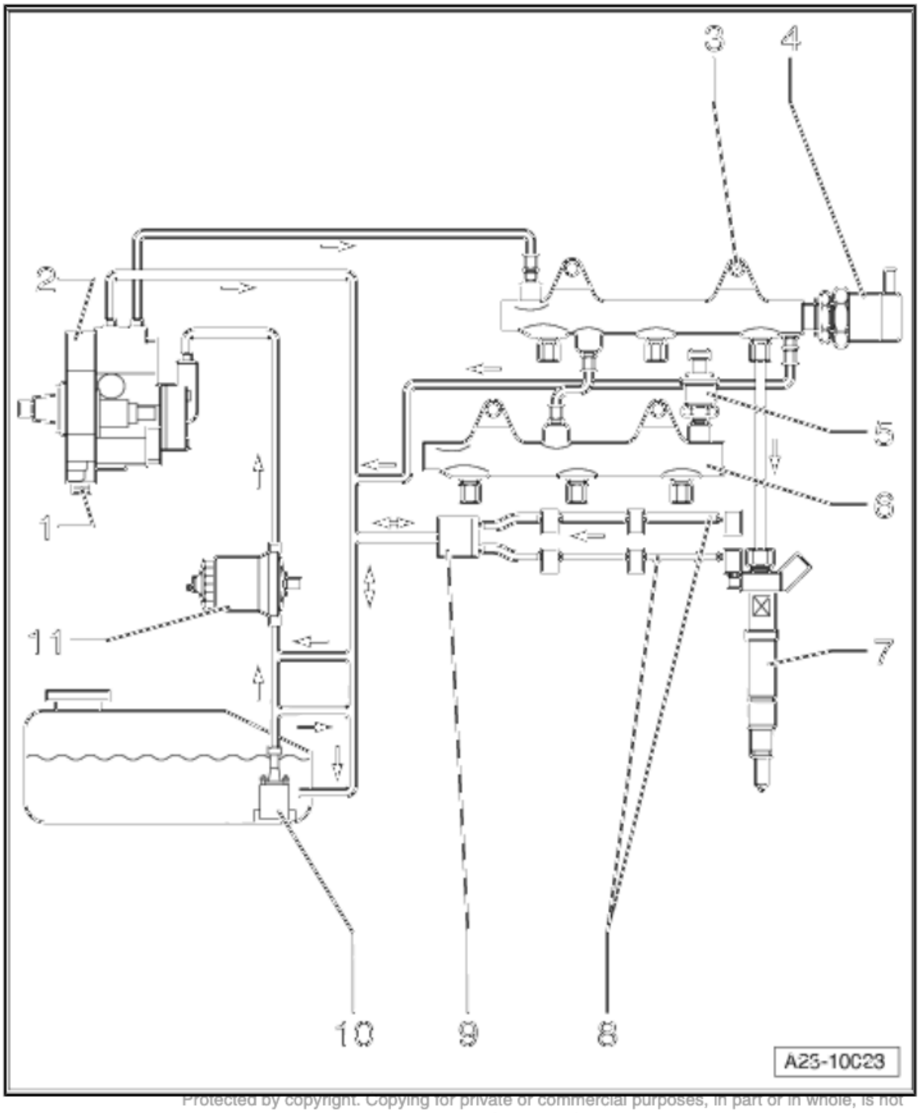
- ❑ With gear-type fuel system pressurisation pump
- ❑ High-pressure pump generates fuel pressure up to 1600 bar
- ❑ Gear-type fuel system pressurisation pump generates fuel pressure between 4 and 5 bar
- ❑ Overview: vehicles up to 08.2005 ⇒ page 69 ; vehicles from 08.2005 onwards ⇒ page 76
- ❑ Removing and installing: vehicles up to 08.2005 ⇒ “1.28 Removing and installing high-pressure pump - vehicles up to 08.2005”, page 72 ; vehicles from 08.2005 onwards ⇒ page 79

3 - Rail element (high-pressure reservoir)

- ❑ Cylinder bank 1

4 - Fuel pressure regulating valve - N276-

- ❑ On cylinder bank 1
- ❑ Removing and installing



⇒ page 94

5 - Fuel pressure sender - G247-

- ☐ On cylinder bank 2
- ☐ Removing and installing ⇒ page 98

6 - Rail element (high-pressure reservoir)

- ☐ For cylinder bank 2

7 - Injectors (piezo injectors)

- ☐ Injectors 1 ... 6
- ☐ Removing and installing ⇒ page 52

8 - Fuel return lines (from injectors)

- ☐ The fuel return lines must not be dismantled; if necessary they must be renewed complete with pressure retention valve.
- ☐ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system. Then check fuel return lines for leaks.

9 - Pressure retention valve

- ☐ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines.
- ☐ This residual pressure is required for the control function of the piezo injectors.
- ☐ The pressure retention valve may only be renewed together with the fuel return lines.
- ☐ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- ☐ Checking pressure retention valve ⇒ page 52

10 - Fuel system pressurisation pump - G6-

- ☐ Pressure from fuel system pressurisation pump approx. 1 bar

11 - Fuel filter

- ☐ Exploded view - fuel filter ⇒ Rep. gr. 20
- ☐ Renewing ⇒ Rep. gr. 20

1.6 Exploded view - fuel system

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

1 - Bracket with fuel filter
  - ☐ Exploded view - fuel filter ⇒ Rep. gr. 20
  - ☐ Renewing ⇒ Rep. gr. 20

2 - Fuel return line

3 - Fuel supply line

4 - Clip

5 - Banjo bolt for fuel return line

6 - Fuel temperature sender - G81-

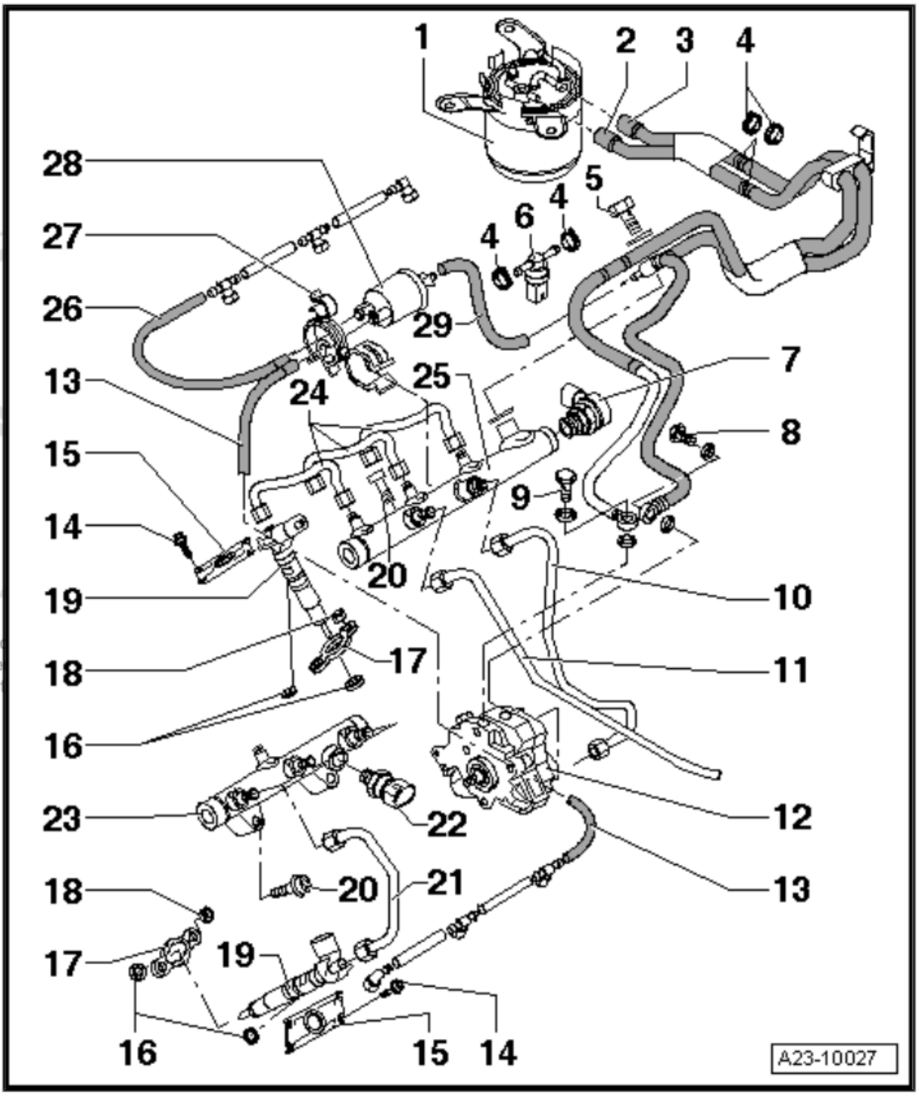
7 - Fuel pressure regulating valve - N276-
  - ☐ Located on cylinder bank 1
  - ☐ Removing and installing ⇒ page 94

8 - Banjo bolt for fuel return line
  - ☐ 25 Nm

9 - Banjo bolt for fuel supply line
  - ☐ 25 Nm

10 - High-pressure fuel pipe
  - ☐ Between high-pressure pump and rail element for cylinder bank 1

11 - High-pressure fuel pipe
  - ☐ Between rail element for cylinder bank 1 and rail element for cylinder



bank 2

12 - High-pressure fuel pump

- With gear-type fuel system pressurisation pump
- High-pressure pump generates fuel pressure up to 1600 bar
- Gear-type fuel system pressurisation pump generates fuel pressure between 4 and 5 bar
- Overview: vehicles up to 08.2005 ⇒ page 69 ; vehicles from 08.2005 onwards ⇒ page 76
- Removing and installing: vehicles up to 08.2005 ⇒ “1.28 Removing and installing high-pressure pump - vehicles up to 08.2005”, page 72 ; vehicles from 08.2005 onwards ⇒ page 79

13 - Fuel return lines (from injectors)

- The fuel return lines must not be dismantled; if necessary they must be renewed complete with pressure retention valve.
- After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system. Then check fuel return lines for leaks.

14 - Bolt

- Cover for injector on cylinder head cover
- 5.5 Nm

15 - Cover for injector

16 - Seal

17 - Clamping piece

- Renew

18 - Hexagon flange nut

- For clamping piece
- 10 Nm

19 - Injector

- Use a coloured pen to mark injectors and corresponding high-pressure pipes and cylinder for re-installation; pay attention to markings when installing
- Always renew copper seal when removing and installing
- To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- (it is important to do this to avoid leaks)
- Removing and installing ⇒ page 52

20 - Bolt

- 22 Nm

21 - High-pressure pipes

- For cylinder bank 2
- 25 Nm

22 - Fuel pressure sender - G247-

- Located on cylinder bank 2
- Removing and installing ⇒ page 98
- 30 Nm

23 - High-pressure reservoir

- For cylinder bank 2

24 - High-pressure pipes

- For cylinder bank 1

25 - High-pressure reservoir

- For cylinder bank 1

26 - Fuel return lines (from injectors)

- ❑ The fuel return lines must not be dismantled; if necessary they must be renewed complete with pressure retention valve.
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system. Then check fuel return lines for leaks.

27 - Retainer

- ❑ For fuel return lines (from injectors)

28 - Pressure retention valve

- ❑ In return lines from cylinder banks 1 and 2
- ❑ The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines.
- ❑ This residual pressure is required for the control function of the piezo injectors.
- ❑ The pressure retention valve may only be renewed together with the fuel return lines.
- ❑ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- ❑ Checking pressure retention valve ⇒ page 52

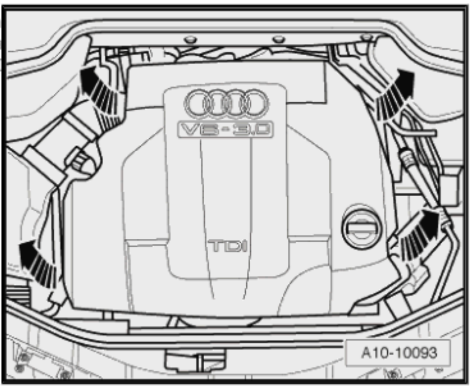
29 - Fuel return line

- ❑ Common return line to fuel tank

1.7 Removing and installing engine cover panel

Removing

– Carefully pull engine cover panel off four retaining pins one after the other "arrows". Do not jerk the cover panel away, and do not try to pull on one side only.



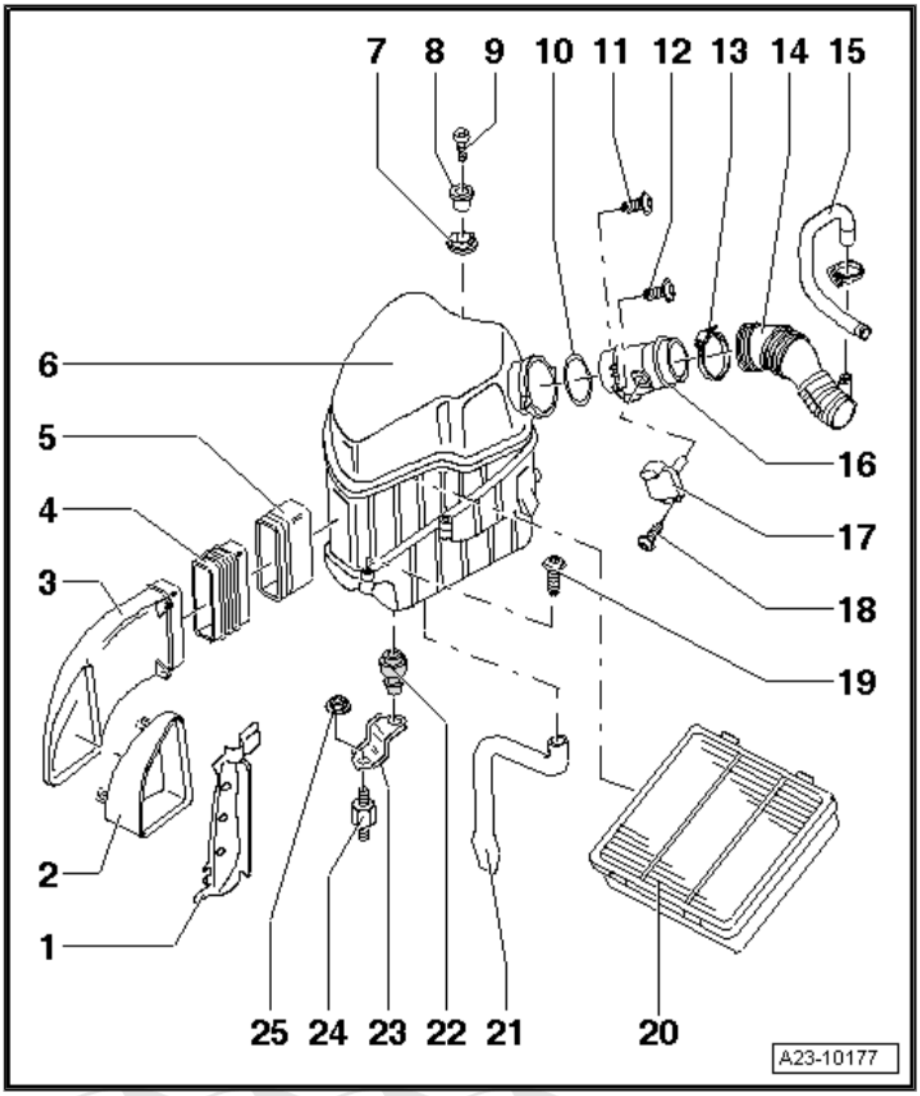
Installing

– To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.

– Position engine cover panel on engine (note locations of oil filler neck and oil dipstick).

– Press engine cover panel with both hands into the rubber grommets at the rear and then into the grommets at the front.

1.8 Exploded view - air cleaner



1 - Intake air duct

2 - Air duct

- ❑ Clean dirt and leaves out of air duct

3 - Air duct

- ❑ Clean dirt and leaves out of air duct

4 - Air duct

- ❑ Clean dirt and leaves out of air duct

5 - Air duct

- ❑ Clean dirt and leaves out of air duct

6 - Air cleaner housing

- ❑ Clean any salt residue, leaves and dirt out of air cleaner housing

7 - Grommet

8 - Bush

9 - Bolt

10 - O-ring

- ❑ Renew if damaged

11 - Bolt

12 - Bolt

13 - Hose clip

14 - Air intake hose leading to throttle valve module - J338-

- ❑ Clean dirt and leaves

out of air duct

15 - Vent hose

16 - Housing for air mass meter - G70-

17 - Air mass meter - G70-
- ❑ Removing and installing ⇒ page 18

18 - Bolt

19 - Bolt

20 - Air filter element
- ❑ Always use genuine part for air filter element
- ❑ Removing and installing ⇒ page 16
- ❑ Observe service intervals ⇒ Maintenance ; Booklet 404
- ❑ Also clean snow screen (if fitted)

21 - Water drain hose
- ❑ Clean any leaves and dirt out of water drain hose
- ❑ Water drain must function properly

22 - Grommet

23 - Retaining clip

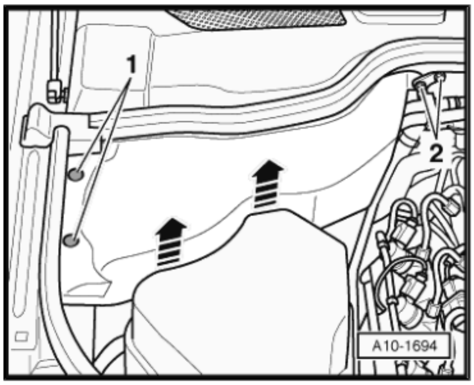
24 - Stop buffer

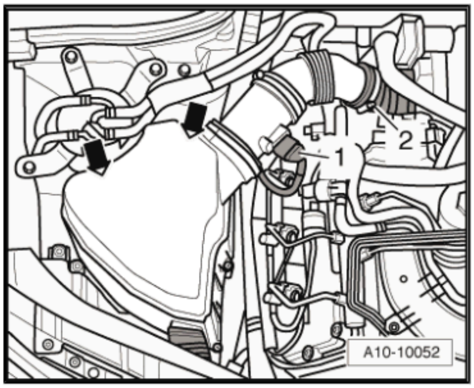
25 - Hexagon flange nut

1.9 Removing and installing air filter element

Removing

- Remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew nut -2-.
- Pull cover out of retainers -arrows-.
- Unplug electrical connector -1- at air mass meter - G70- .
- Detach air intake hose -2- at turbocharger.





- Remove bolts -arrows-.
- Detach air cleaner housing (top section).
- Pull out air filter element.
- Cover the open air cleaner housing with a clean cloth.

Note

Make sure no dirt gets into the air cleaner housing.

Installing

To ensure the proper function of the air mass meter - G70- it is important to observe the following notes and instructions.

Note

- ♦ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter - G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ♦ *Always use genuine part for air filter element.*
- ♦ *Use a silicone-free lubricant when installing the intake hose.*
- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

- Check water drain hose in air cleaner (bottom section) for dirt and other obstructions.
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
- Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).
- Check for dirt in air duct leading to air filter element.
- When installing the air filter element, check that it is properly centred in the retainer in the air cleaner (bottom section).
- Fit the top section of the air cleaner carefully on the bottom section, without using force. Make sure the top section of the air cleaner is fitted straight on the air filter element. Note position of sealing lip on air filter element (to prevent air leaks).

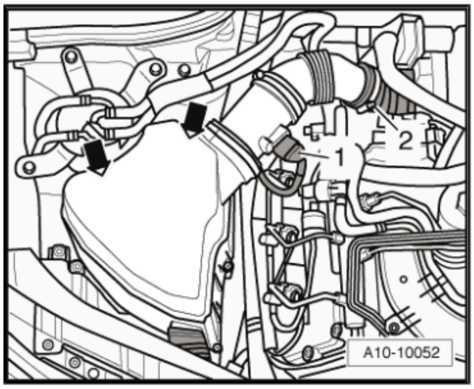
- Then screw top section of air cleaner back onto bottom section.
- The remaining installation steps are carried out in the reverse sequence.

1.10 Removing and installing air mass meter - G70-

Removing

– Unplug electrical connector at air mass meter - G70- -1-.

– Open two hose clips and carefully pull out air mass meter - G70- .



Installing

To ensure the proper function of the air mass meter - G70- it is important to observe the following notes and instructions.

Note

- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter - G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *Use a silicone-free lubricant when installing the intake hose.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

– Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).

– Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing air cleaner ⇒ page 16

– If air cleaner has been removed, clean water drain hose in air cleaner housing (bottom section).

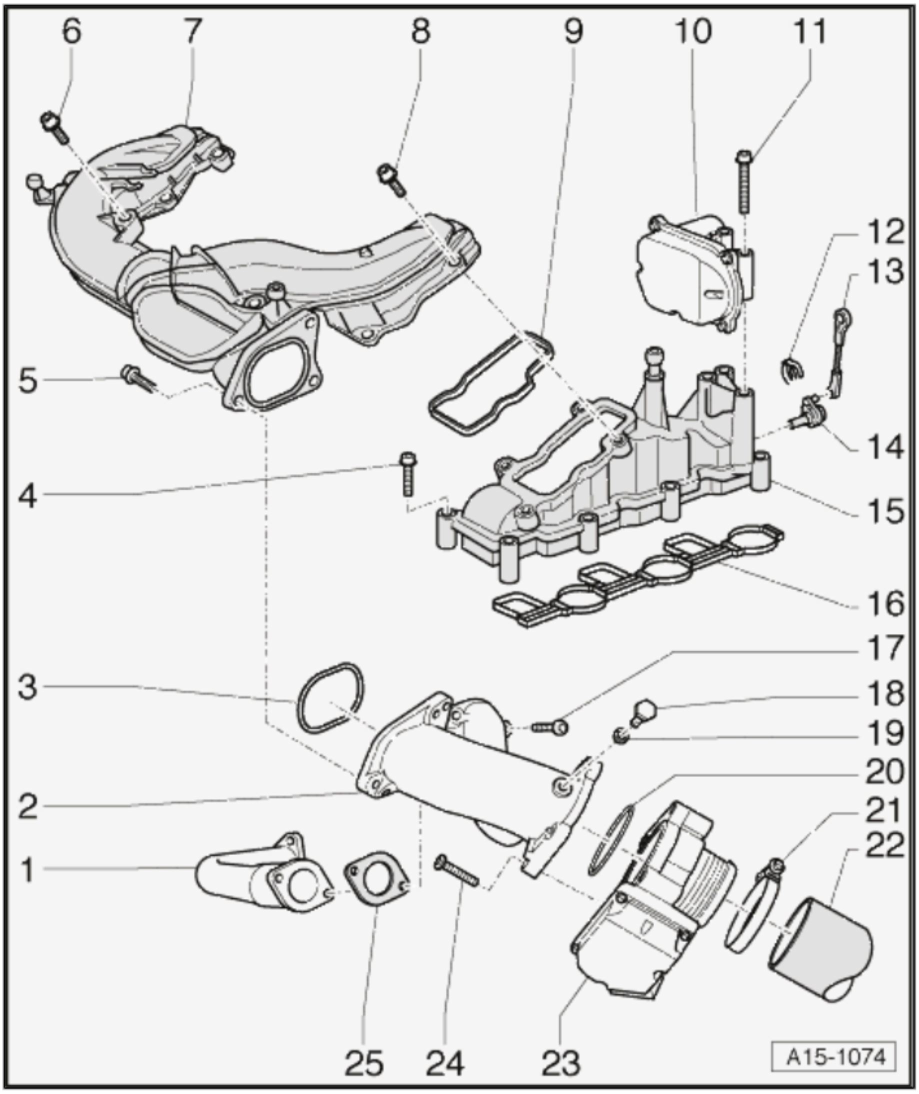
– Align seal in slot on air cleaner housing and carefully push air mass meter - G70- into air cleaner housing.

The remaining installation steps are carried out in the reverse sequence.

1.11 Exploded view - intake manifold

Note

The illustration shows the top section and bottom (left-side) section of the intake manifold.



1 - Connecting pipe for exhaust gas recirculation

2 - Intake connecting pipe

3 - Seal
- ☐ Renew

4 - Bolt
- ☐ 9 Nm
- ☐ Tighten in stages and in diagonal sequence

5 - Bolt
- ☐ 9 Nm

6 - Bolt
- ☐ 9 Nm

7 - Intake manifold (top section)
- ☐ Removing and installing ⇒ page 20

8 - Bolt
- ☐ 9 Nm

9 - Gasket
- ☐ Renew

10 - Intake manifold flap motor
- ☐ Cylinder bank 1 (right-side): intake manifold flap motor - V157-
- ☐ Cylinder bank 2 (left-side): intake manifold flap motor - V275-
- ☐ Removing and installing ⇒ page 35

11 - Bolt

12 - Securing clip
- ☐ Not available as separate replacement part

13 - Connecting rod
- ☐ Not available as separate replacement part

14 - Coupling
- ☐ Not available as separate replacement part

15 - Bottom section of intake manifold (left-side)
- ☐ Removing and installing: vehicles up to 10.2004 ⇒ page 21 ; vehicles from 10.2004 onwards ⇒ page 25 (left-side) and ⇒ page 30 (right-side)

16 - Gasket
- ☐ Renew

17 - Bolt
- ☐ 9 Nm

18 - Screw plug
- ☐ 25 Nm

19 - Seal
- ☐ Renew

20 - Seal

- ❑ Renew

21 - Retaining clamp

- ❑ Reinforced
- ❑ 5.5 Nm

22 - Air hose

- ❑ Must be free of oil and grease when installing

23 - Throttle valve module - J338-

24 - Bolt

- ❑ 9 Nm

25 - Gasket

- ❑ Renew

1.12 Removing and installing intake manifold (top section)

Removing

– Pull off engine cover ⇒ page 14 .

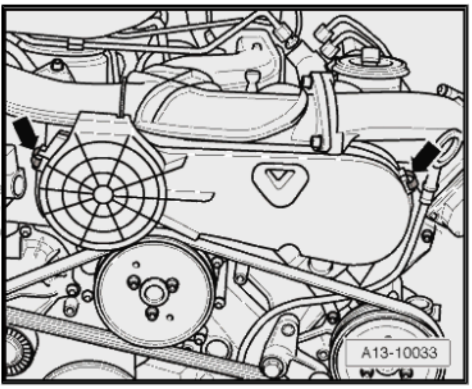
Caution

Observe rules for cleanliness when working on the injection system ⇒ page 2 .

– Pull oil dipstick out of guide tube.

– Loosen clamps -arrows-.

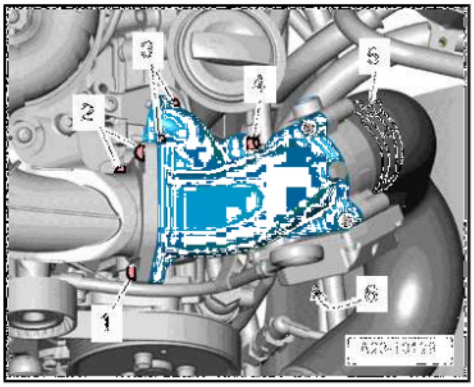
– Swing toothed belt cover forwards.



– Disconnect air intake hose -5- from throttle valve module - J338- .

– Unplug electrical connector -6- at throttle valve module - J338- .

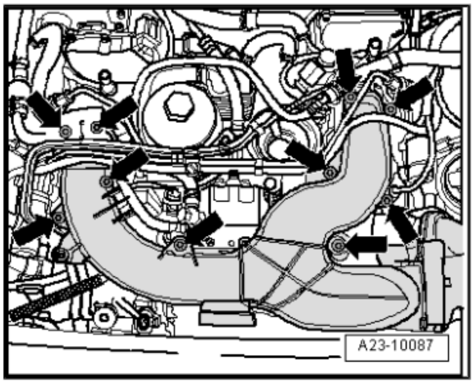
– Remove bolts -3- and -4-.



Note

Disregard items -1- and -2-.

- Remove bolts -arrows-.
- Detach intake manifold (top section) together with intake connecting pipe and throttle valve module - J338- .



Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets and seals.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

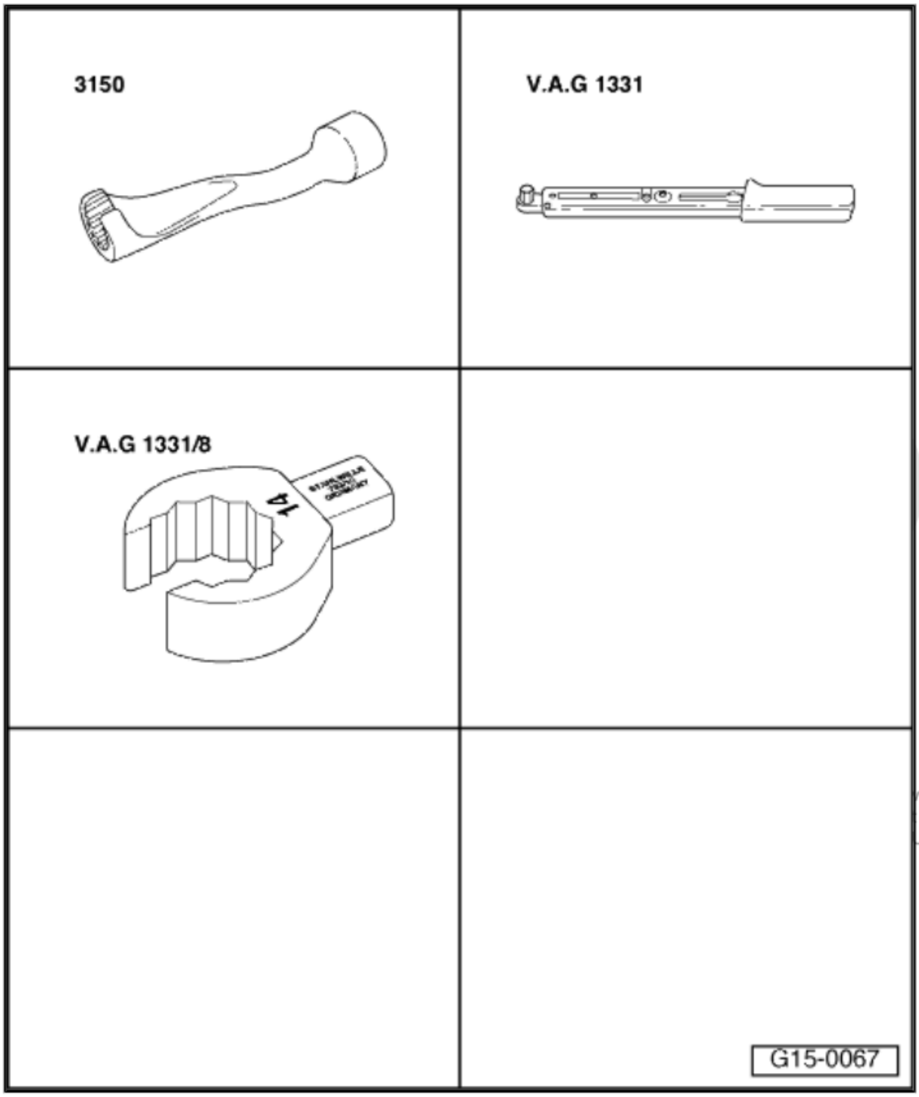
Tightening torques

Component	Nm
Intake manifold (top section) to intake manifold (bottom section)	9
Intake connecting pipe to intake manifold (top section)	9
Intake connecting pipe to connecting pipe	9
Hose clips (9 mm wide)	3
Hose clips (13 mm wide)	5.5

1.13 Removing and installing intake manifold (left and right bottom sections) - vehicles up to 10.2004

Special tools and workshop equipment required

- Socket, 14 mm - 3150-
- Torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1-
- Socket insert AF 14, flared ring spanner - V.A.G 1331/8-



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Removing

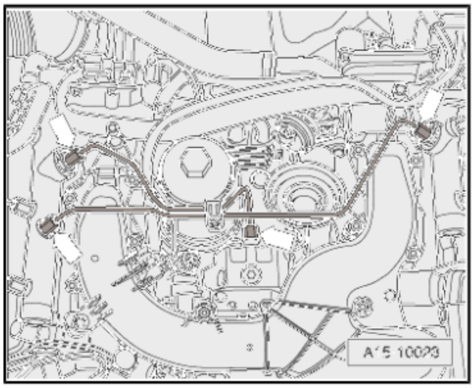
Note

- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- *The intake manifold (bottom section) can only be renewed together with the intake manifold flap motor as one unit*

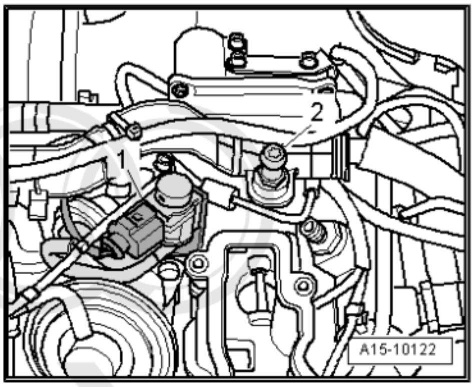
– Pull off engine cover ⇒ page 14 .

Caution

Observe rules for cleanliness when working on the injection system ⇒ page 2 .

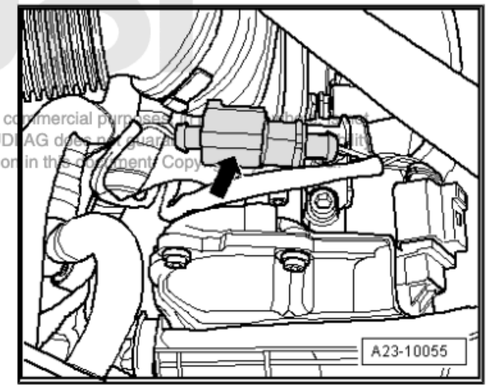


- Unscrew union nuts -arrows- and detach high-pressure pipes.
- Remove intake manifold (top section) ⇒ page 20 .

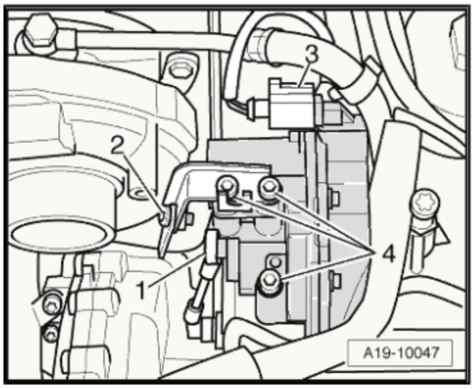


- Unscrew retaining pin -2- for engine cover panel at intake manifold (bottom section).
- If fitted, remove change-over valve for exhaust gas recirculation cooler - N345- -item 1- with bracket.

Bottom section of intake manifold (right-side):



- Take electrical connector -arrow- for exhaust gas temperature sender 1 - G235- out of bracket.



- Remove bolt -2-.

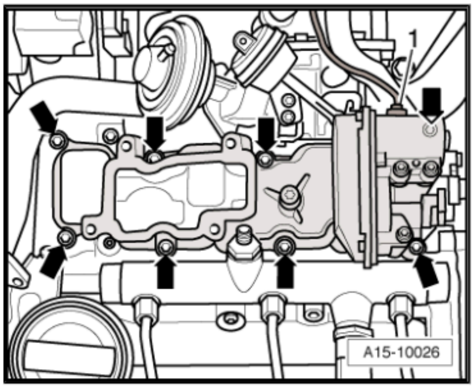
Note

Disregard -items 1, 3, 4-.

- Detach electrical connectors at glow plugs on cylinder bank (right-side).

Continuation for both sides:

– Detach electrical connector -1- at intake manifold flap motor.
– Remove bolts -arrows- and detach intake manifold (bottom section) with intake manifold flap motor.



Note

Block off intake ports in cylinder head with clean rags.

Installing

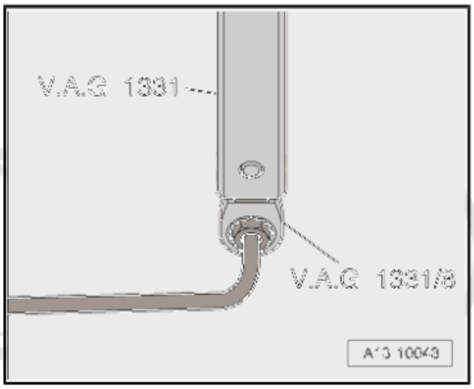
Installation is carried out in the reverse order; note the following:

Note

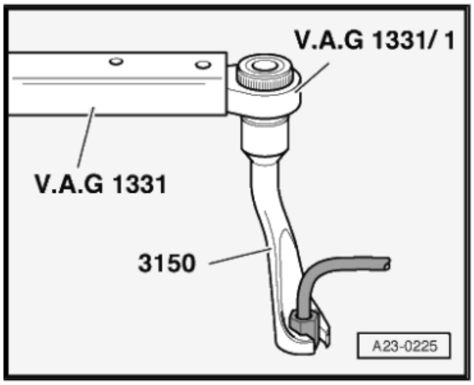
- ♦ *Renew seals and gaskets.*
- ♦ *Fit all cable ties in the original positions when installing.*

– Install intake manifold (top section) ⇒ page 20 .

– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with socket insert AF 14, flared ring spanner - V.A.G 1331/8- .



- To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket, 14 mm - 3150- .



Tightening torques

Component		Nm
Intake manifold (bottom section) to cylinder head		9
Retaining pin for engine cover panel to intake manifold (bottom section)		5
High-pressure pipes to:	High-pressure pump	25
	Rail element	25

- Check fuel system for leaks.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes and then switch off.
- Switch off ignition.
- Check the complete fuel system including all 6 return line connections for leaks.

Renew the affected component if leakage still occurs after tightening to the correct torque.

Note

The return lines can only be renewed together with the pressure retention valve as one unit.

- After completing the repair, road-test the vehicle over a distance of at least 20 km. Accelerate with full throttle at least once. Then inspect the high-pressure section of the fuel system again for leaks.

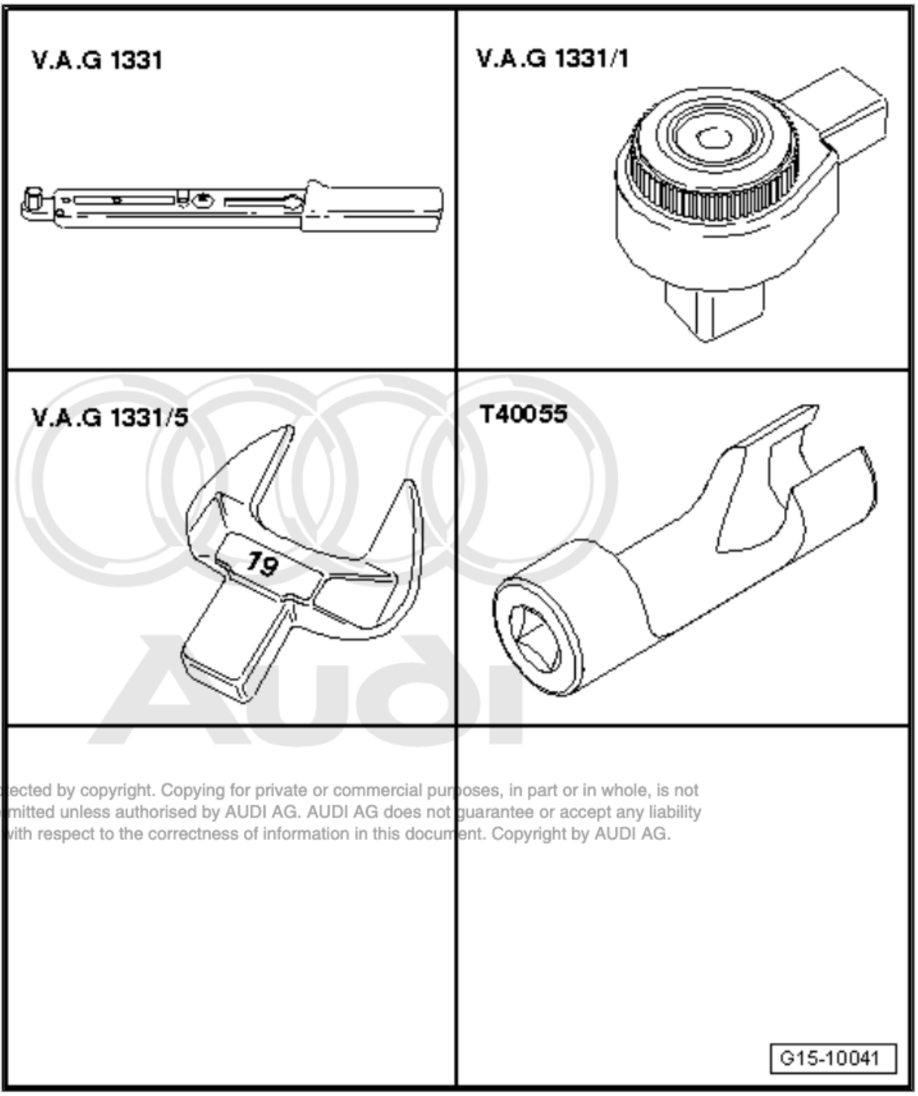
Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

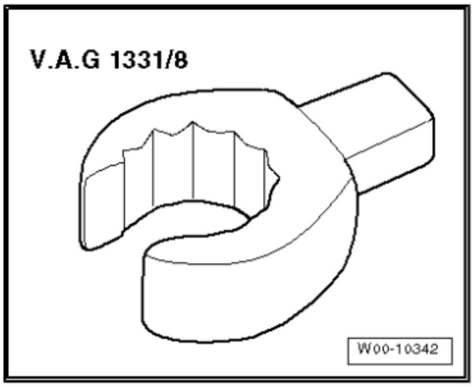
1.14 Removing and installing left-side intake manifold (bottom section) - vehicles from 10.2004 onwards

Special tools and workshop equipment required

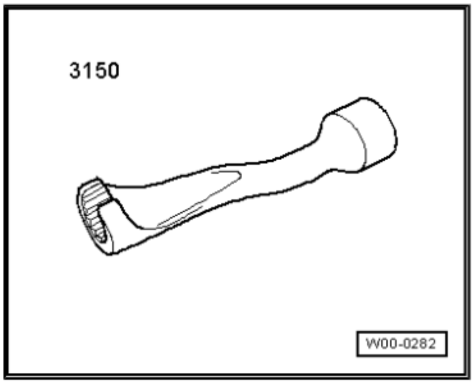
- Torque wrench - V.A.G 1331-
- Open end spanner insert, AF 19 - V.A.G 1331/5- (vehicles from 08.2005 onwards)
- Ratchet - V.A.G 1331/1-
- Socket - T40055- (17 mm), (vehicles from 08.2005 onwards)



- Socket insert AF 14, flared ring spanner - V.A.G 1331/8- (vehicles up to 08.2005)



- ◆ Socket, 14 mm - 3150- (vehicles up to 08.2005)



Removing

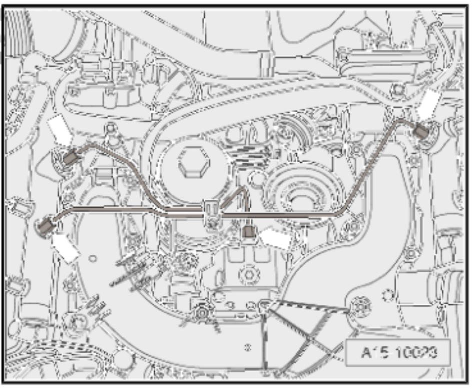
> **Caution**
>
> *Observe rules for cleanliness when working on the injection system ⇒ page 2 .*

– Remove intake manifold (top section) ⇒ page 20 .

– Drain off coolant ⇒ Rep. gr. 19 .

Vehicles up to 08.2005:

– Unscrew union nuts -arrows- and detach high-pressure pipes.

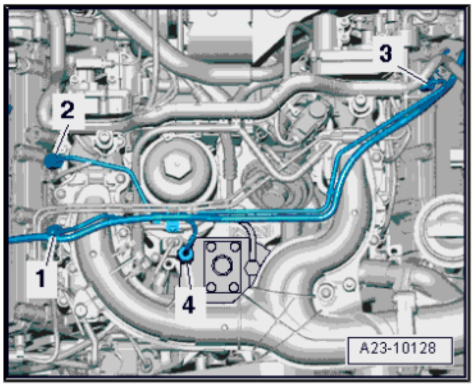


Vehicles from 08.2005 onwards:

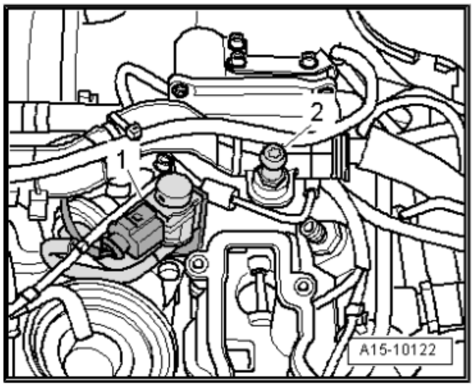
– Unscrew union nuts -1 ... 4- and detach high-pressure pipes.

All vehicles:

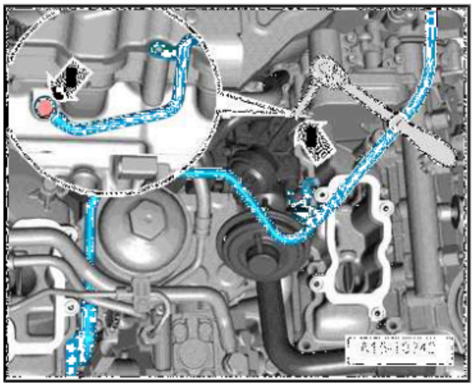
– Remove mechanical exhaust gas recirculation valve ⇒ Rep. gr. 26 .



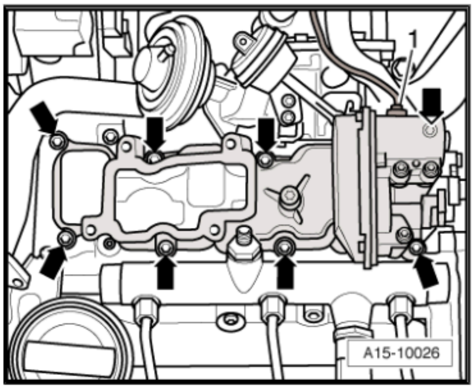
- Unscrew retaining pin -2- for engine cover panel at intake manifold (bottom section).
- Unclip exhaust gas recirculation cooler change-over valve - N345- -item 1- from bracket.
- Remove bracket for exhaust gas recirculation cooler change-over valve - N345- .



- Remove banjo bolt for coolant bleeder line using jointed wrench as illustrated.



- Unplug electrical connector -1- at intake manifold flap 2 motor - V275- .
- Remove bolts -arrows- and detach intake manifold (bottom section) with intake manifold flap motor 2 - V275- .
- Move coolant bleeder line to one side and remove left-side intake manifold (bottom section).



Note

Block off intake ports in cylinder head with clean rags.

Installing

Installation is carried out in the reverse order; note the following:

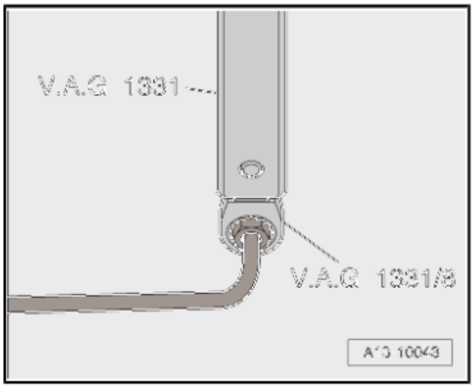
Note

Renew gaskets and seals.

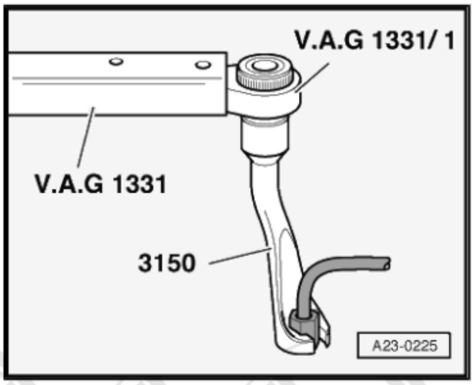
- Fit banjo bolt for coolant bleeder line with a new seal and screw in 2 … 3 turns, before installing left-side intake manifold (bottom section).
- Install mechanical exhaust gas recirculation valve ⇒ Rep. gr. 26 .
- Install intake manifold (top section) ⇒ page 20 .
- Tighten union nuts on high-pressure pipes hand-tight initially.
- Ensure that high-pressure pipes are not under tension.

Vehicles up to 08.2005:

- To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with socket insert AF 14, flared ring spanner - V.A.G 1331/8- .

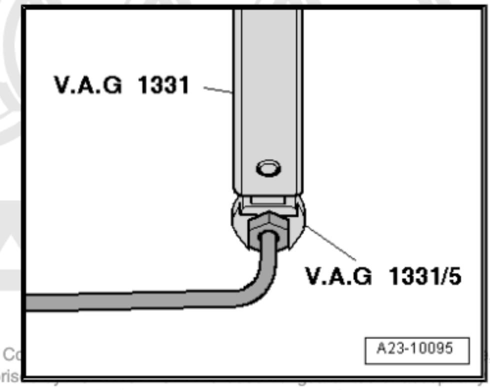


- To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket, 14 mm - 3150- .

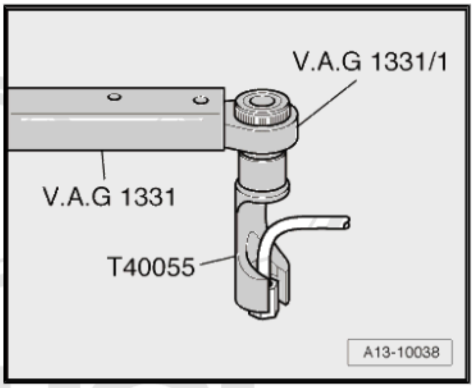


Vehicles from 08.2005 onwards:

- To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with open end spanner insert, AF 19 - V.A.G 1331/5- .



- To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- , 17 mm.



All vehicles:

- Fill cooling system ⇒ Rep. gr. 19 .

Tightening torques

Component	Nm
Intake manifold (bottom section) to cylinder head	9
High-pressure pipes	25
Banjo bolt for coolant bleeder line	15.5

- Check fuel system for leaks.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes and then switch off.
- Switch off ignition.
- Check the complete fuel system including all 6 return line connections for leaks.

Renew the affected component if leakage still occurs after tightening to the correct torque.

Note

The return lines can only be renewed together with the pressure retention valve as one unit.

- After completing the repair, road-test the vehicle over a distance of at least 20 km. Accelerate with full throttle at least once. Then inspect the high-pressure section of the fuel system again for leaks.

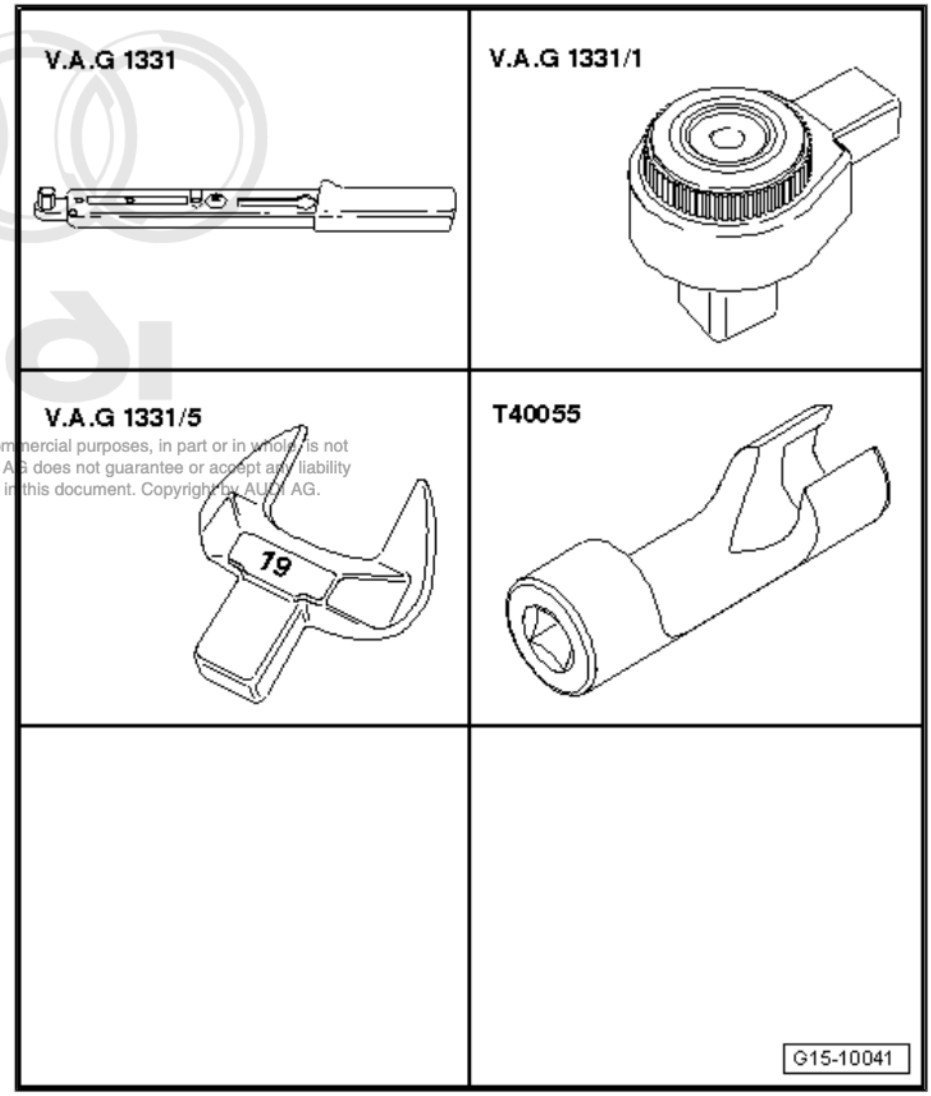
Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

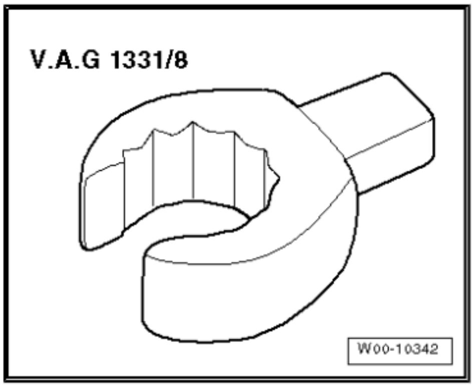
1.15 Removing and installing right-side intake manifold (bottom section) - vehicles from 10.2004 onwards

Special tools and workshop equipment required

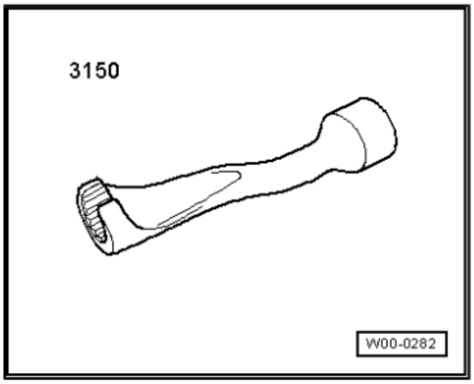
- Torque wrench - V.A.G 1331-
- Open end spanner insert, AF 19 - V.A.G 1331/5- (vehicles from 08.2005 onwards)
- Ratchet - V.A.G 1331/1-
- Socket - T40055- (17 mm), (vehicles from 08.2005 onwards)



- Socket insert AF 14, flared ring spanner - V.A.G 1331/8- (vehicles up to 08.2005)



- Socket, 14 mm - 3150- (vehicles up to 08.2005)



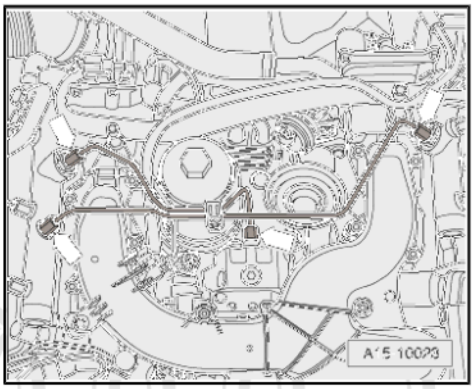
Removing

> **Caution**
>
> *Observe rules for cleanliness when working on the injection system ⇒ page 2 .*

– Remove intake manifold (top section) ⇒ page 20 .

Vehicles up to 08.2005:

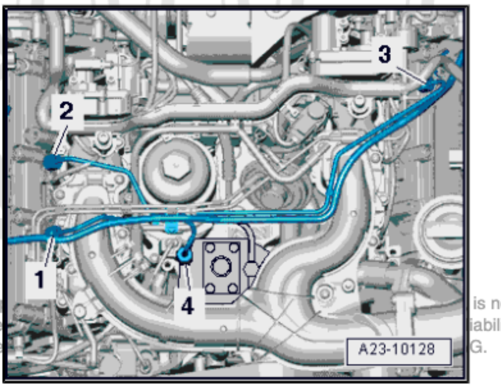
– Unscrew union nuts -arrows- and detach high-pressure pipes.



Vehicles from 08.2005 onwards:

– Unscrew union nuts -1 ... 4- and detach high-pressure pipes.

All vehicles:



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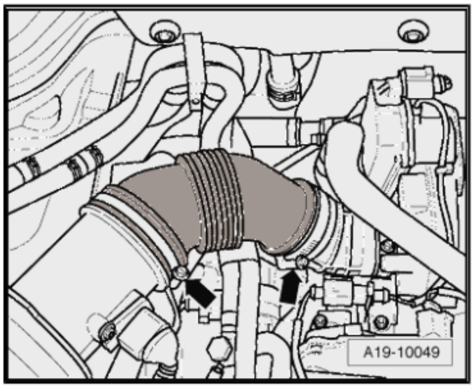
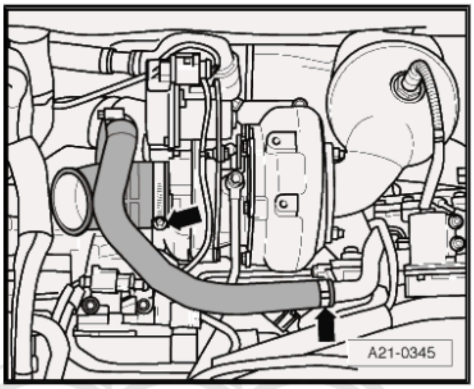
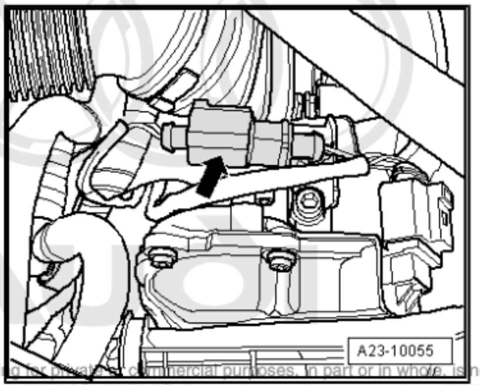
- Release hose clips -arrows- and remove air pipe between turbocharger and air mass meter - G70- .



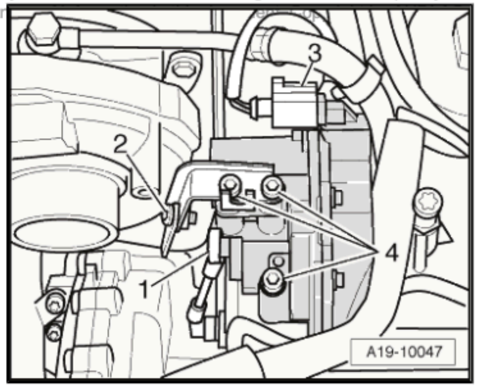
- Remove air intake hose together with crankcase breather hose -arrows-.



- Take electrical connector -arrow- for exhaust gas temperature sender 1 - G235- out of bracket.
- Detach electrical connector -3- at intake manifold flap motor - V157- .



- Remove bolt -2-.

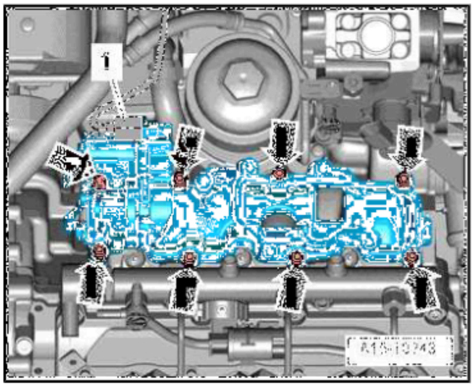


Note

Disregard items -1- and -4-.

- Unplug electrical connectors at glow plugs on cylinder bank (right-side).

- Remove bolts -arrows- and detach bottom section of intake manifold (right-side).



Note

- ♦ *Disregard -item 1-.*
- ♦ *Block off intake ports in cylinder head with clean rags.*

Installing

Installation is carried out in the reverse order; note the following:

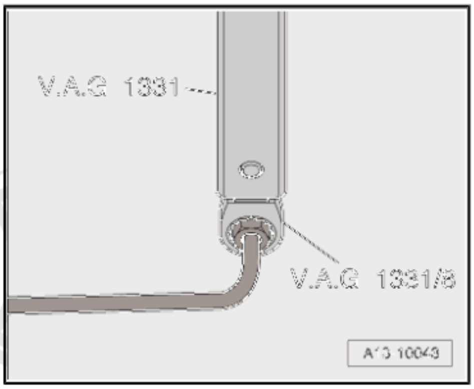
Note

Renew seals and gaskets.

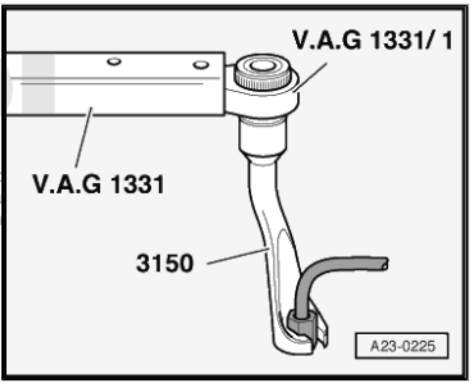
- Install intake manifold (top section) ⇒ page 20 .
- Tighten union nuts on high-pressure pipes hand-tight initially.
- Ensure that high-pressure pipes are not under tension.

Vehicles up to 08.2005:

- To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with socket insert AF 14, flared ring spanner - V.A.G 1331/8- .

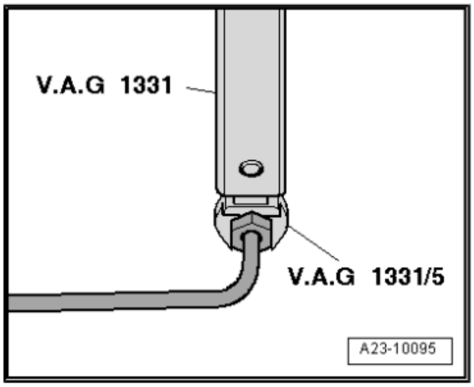


- To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket, 14 mm - 3150- .

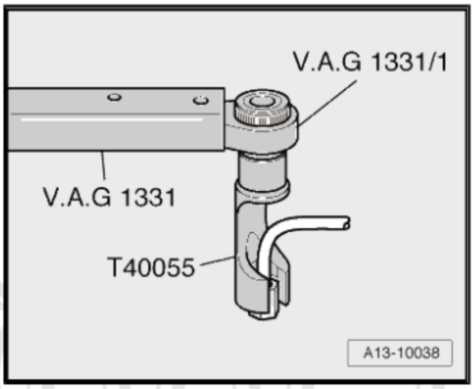


Vehicles from 08.2005 onwards:

- To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with open end spanner insert - V.A.G 1331/5- .



- To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- , 17 mm.



Tightening torques

Component	Nm
Intake manifold (bottom section) to cylinder head	9
High-pressure pipes	25

- Check fuel system for leaks.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes and then switch off.
- Switch off ignition.
- Check the complete fuel system including all 6 return line connections for leaks.

Renew the affected component if leakage still occurs after tightening to the correct torque.

Note

The return lines can only be renewed together with the pressure retention valve as one unit.

- After completing the repair, road-test the vehicle over a distance of at least 20 km. Accelerate with full throttle at least once. Then inspect the high-pressure section of the fuel system again for leaks.

Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

1.16 Removing and installing intake manifold flap motor - V157- or intake manifold flap 2 motor - V275-

Special tools and workshop equipment required

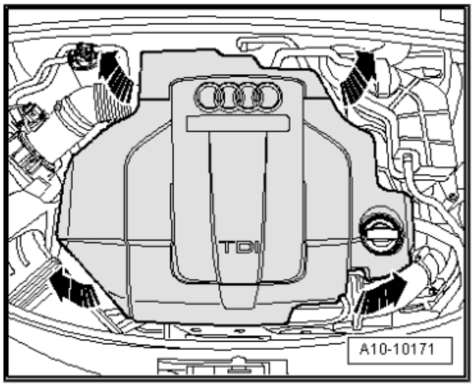
- ♦ Tester - VAS 6395/1-

- Connection lead - VAS 6395/4-2-

Removing

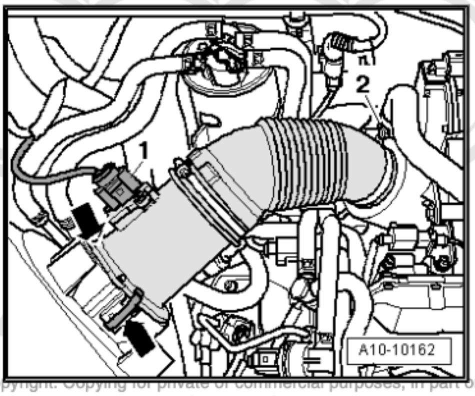
Note

In the following the procedures for removing and installing are described for the intake manifold flap motor - V157- for cylinder bank 1 (right-side). The procedure for the intake manifold flap 2 motor - V275- is basically the same.



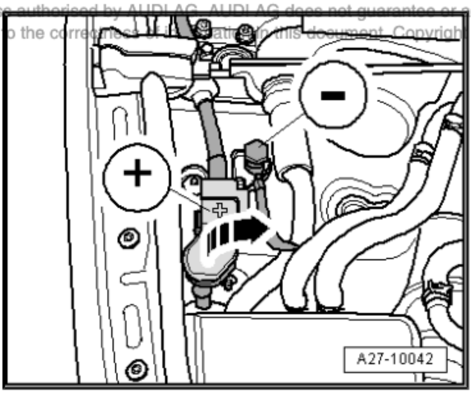
Proceed as follows:

– Carefully pull engine cover panel off four retaining pins one after the other -arrows-.



– Unplug electrical connector -1- at air mass meter - G70- .

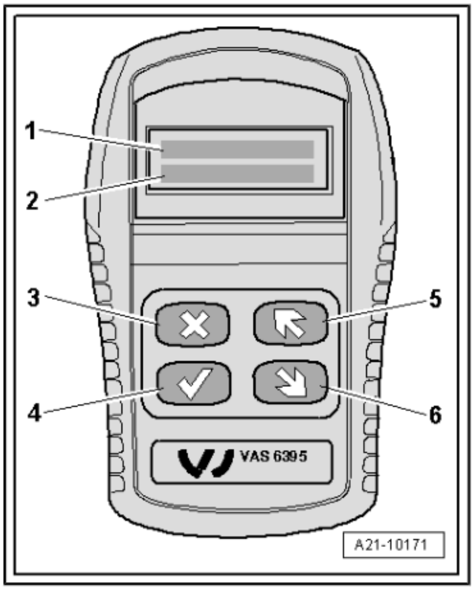
– Remove air intake hose. To do so, release hose clip -2- and clamps -arrows-.



– Open cover -arrow- above positive terminal.

– Connect tester - VAS 6395/1- with connection lead - VAS 6395/4-2- to positive terminal “+” and negative terminal “–”.

Checking software version of tester - VAS 6395/1- :



Caution

Risk of damage to intake manifold flap motor.

- *Before continuing, check whether the correct software version is loaded in the tester - VAS 6395/1- . To do so, proceed as follows:*

Display on -VAS 6395/1- (2 seconds after connecting to power supply) if correct software version is loaded:

1 - >TEST

2 - LEARN

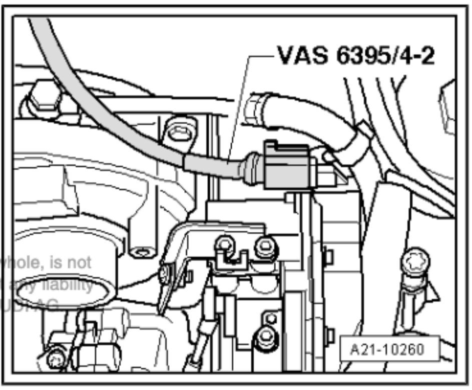
Note

- *If the following appears on the display, an incorrect software version has been loaded:*
- *1. START*
- *2. NEXT*
- *If this is the case, download the correct software version from the “Audi ServiceNet” under “Workshop Equipment”.*

Continuation of procedure:

– Unplug electrical connector for intake manifold flap motor - V157- .

– Connect connecting wire - VAS 6395/4-2- to intake manifold flap motor - V157- and tester - VAS 6395/1- .

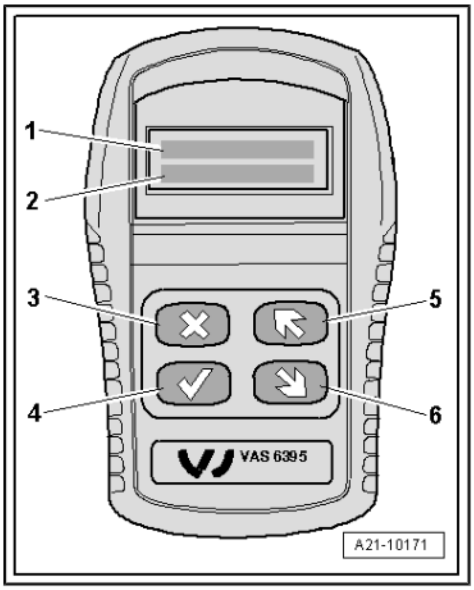


Display on -VAS 6395/1- :

1 - >TEST

2 - LEARN

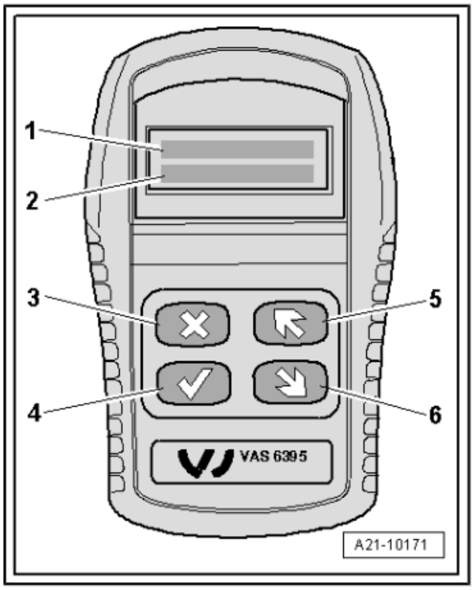
– To continue, press ☑ button -item 4-.



Display on -VAS 6395/1- :

1 - CHECK

2 - S: XX % I: XX %



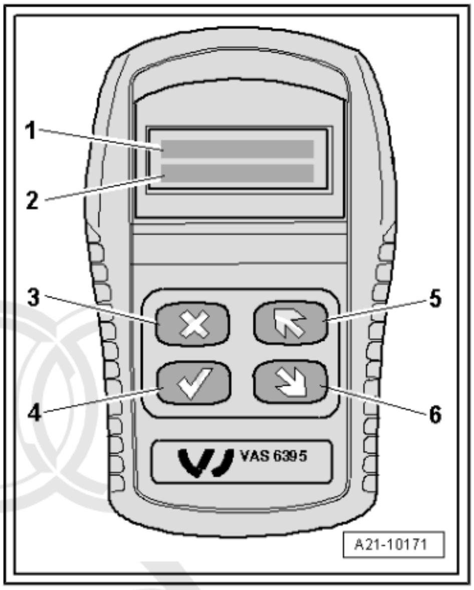
Note

- *S means specified value*
- *I means actual value*

- The tester - VAS 6395/1- runs through the adjustment range of the intake manifold flap motor - V157- and checks the feedback of the positions.

Display on -VAS 6395/1- if intake manifold flap motor is OK:

1 - ACTUATOR OK



- The test is completed.

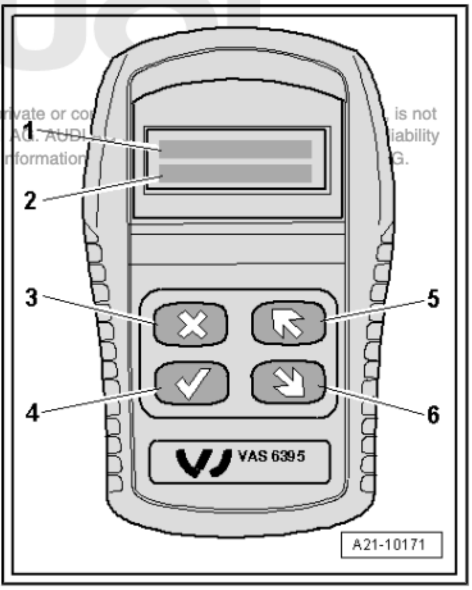
– Unplug electrical connectors for tester - VAS 6395/1- .

Assemble in reverse order.

Display on -VAS 6395/1- if intake manifold flap motor is not OK:

1 - PROBLEM

- Intake manifold flap motor - V157- must be renewed.



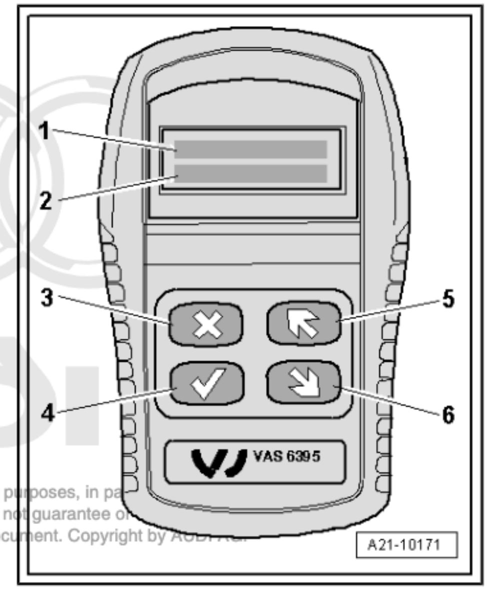
- To do so, proceed as follows:
- To continue, press ✓ button -item 4-.

Display on -VAS 6395/1- :

1 - >TEST

2 - LEARN

- Press ↓ button -item 6-.

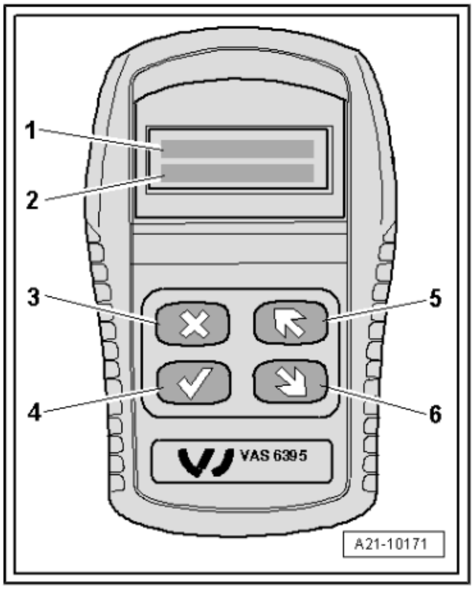


Display on -VAS 6395/1- :

1 - TEST

2 - >LEARN

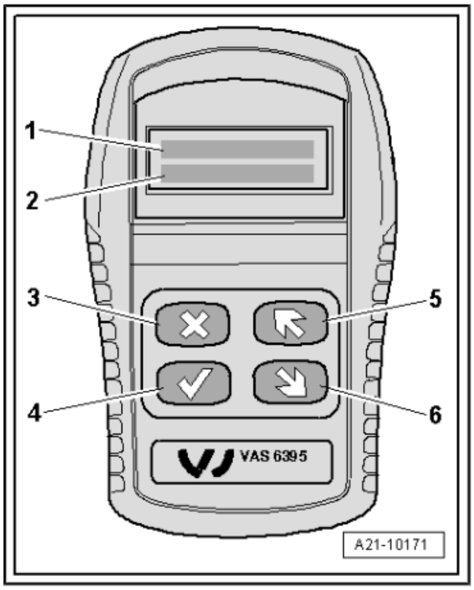
- To continue, press ✓ button -item 4-.



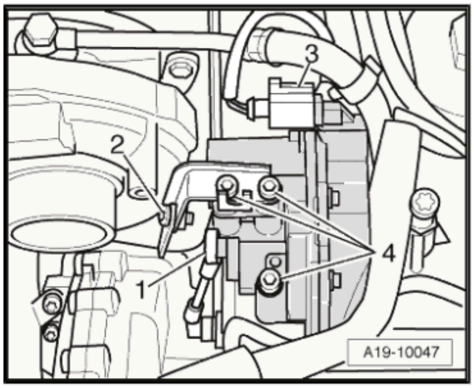
Display on -VAS 6395/1- :

1 - STEP 1

- By pressing buttons ↑ -item 5- and ↓ -item 6-, adjust intake manifold flap motor - V157- in such a way that coupling rod can be accessed easily for removal.



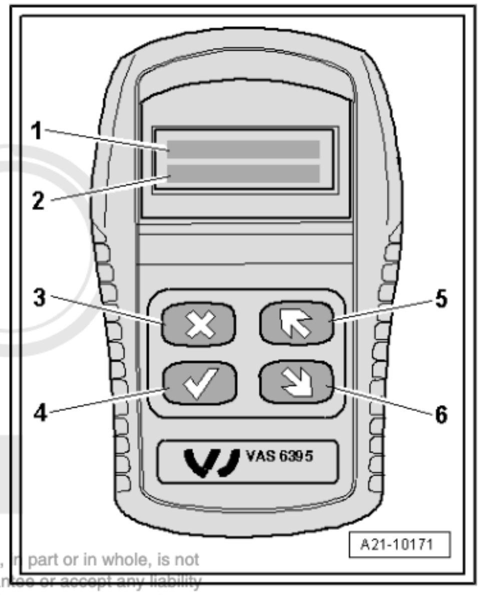
– Unclip coupling rod -1- from intake manifold flap motor - V157- .



Note

Disregard items -2, 3 and 4-.

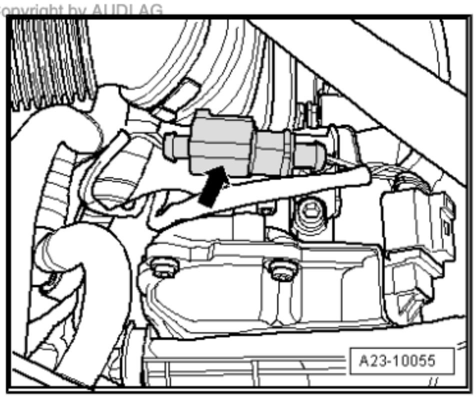
– To continue, press ☑ button -item 4-.



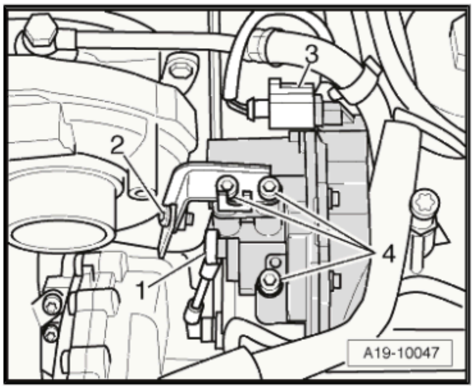
Display on -VAS 6395/1- :

1 - STEP 2

– If fitted, take electrical connector -arrow- from intake manifold flap motor - V157- out of bracket.



– Disconnect connecting wire - VAS 6395/4-2- -item 3- from intake manifold flap motor - V157- .



Caution

Power supply for tester - VAS 6395/1- must remain connected.

– Remove bolts -2- and -4-.

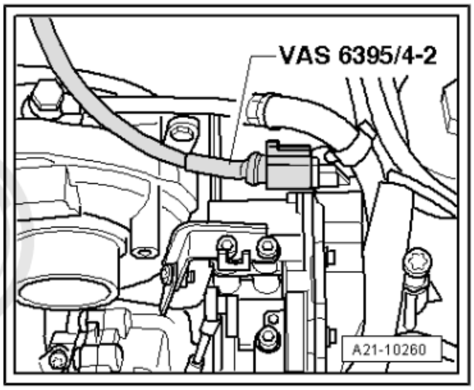
– Detach and dispose of old intake manifold flap motor - V157- .

- Install new intake manifold flap motor - V157- in reverse order of removal and clip coupling rod on.

Note

On version with thread-forming bolt, proceed as follows: Fit and screw in bolt by hand so that it is screwed into old thread. Then tighten bolts to torque.

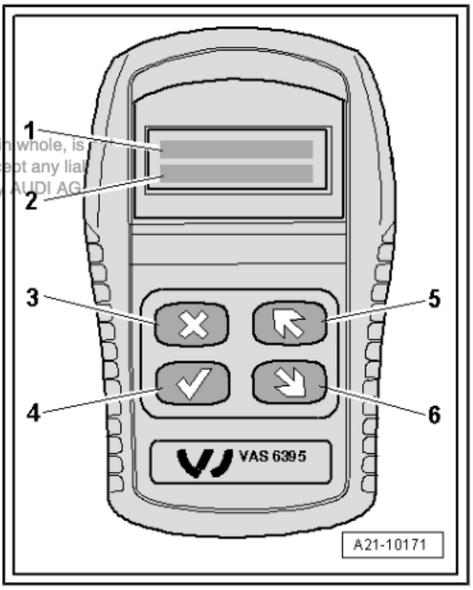
- Connect connecting wire - VAS 6395/4-2- to intake manifold flap motor - V157- .



- To confirm that a new intake manifold flap motor - V157- has been installed, press ☑ button -item 4-.

Display on -VAS 6395/1- :

1 - STEP 3

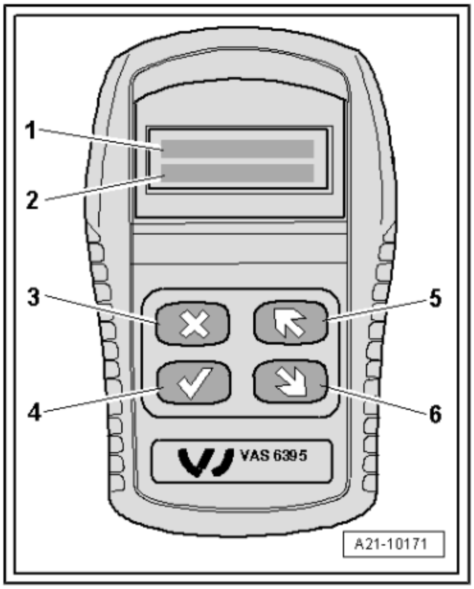


- To continue, press ☑ button -item 4-.

Display on -VAS 6395/1- :

1 - WARNING

2 - LEARNING



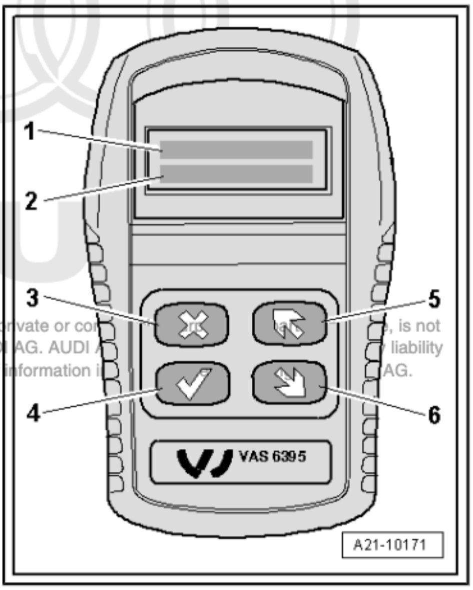
- To continue, press ☑ button -item 4-.

Display on -VAS 6395/1- :

1 - TEST 1

2 - S: 84.0 % I: XX %

- Specification = 84 %



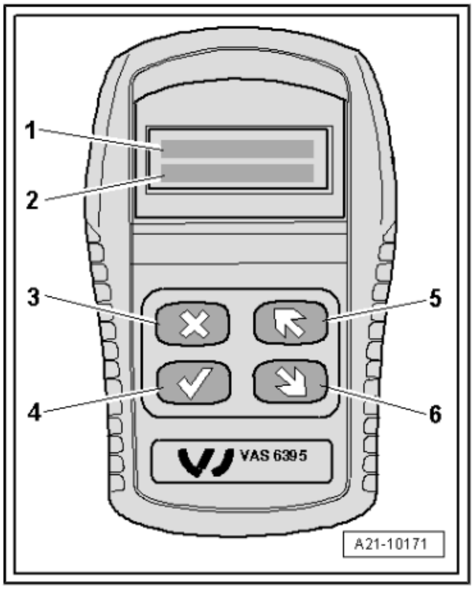
- To continue, press ☑ button -item 4-.

Display on -VAS 6395/1- :

1 - TEST 2

2 - S: 16.0 % I: XX %

- Specification = 16 %



- To continue, press ☑ button -item 4-.

Display on -VAS 6395/1- :

1 - TEST 3

2 - S: XX % I: XX %

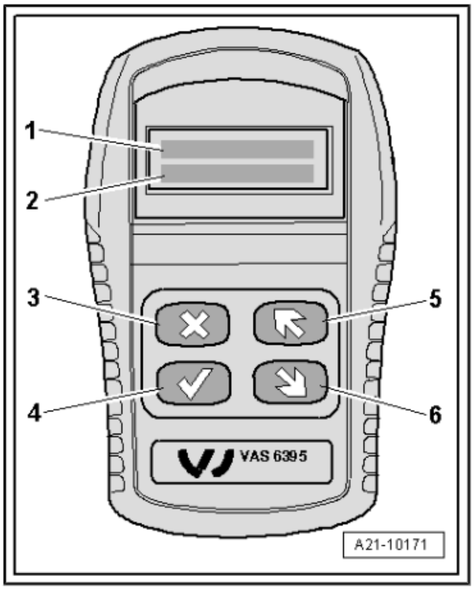
- Adjustment range of intake manifold flap motor - V157- is checked.

Display on -VAS 6395/1- :

1 - OK

- To confirm, press ☑ button -item 4-.
- Adjustment is completed.
- Unplug electrical connectors for tester - VAS 6395/1- .

Assemble in reverse order.



1.17 Checking injectors

There are four different tests for checking the operation of the injectors.

- ⇒ “1.18 Adaption of injector delivery calibration values and injector voltage calibration values”, page 43 .
- ⇒ “1.19 Checking for injectors sticking open (piezo injectors)”, page 44
- ⇒ “1.20 Measuring return flow rate of injectors with engine running”, page 46
- ⇒ “1.21 Checking return flow rate of injectors at starter cranking speed”, page 49

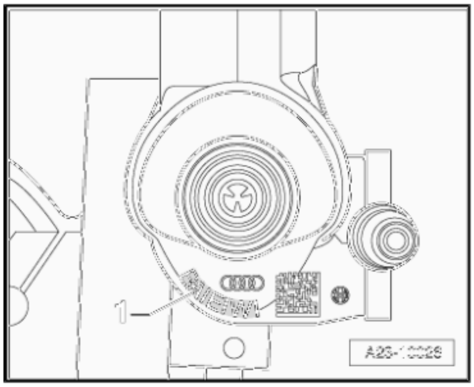
Perform the following tests first if the engine does not start at all:

- ⇒ “1.19 Checking for injectors sticking open (piezo injectors)”, page 44
- ⇒ “1.21 Checking return flow rate of injectors at starter cranking speed”, page 49
- ⇒ “1.34 Checking fuel pressure regulating valve N276 ”, page 93

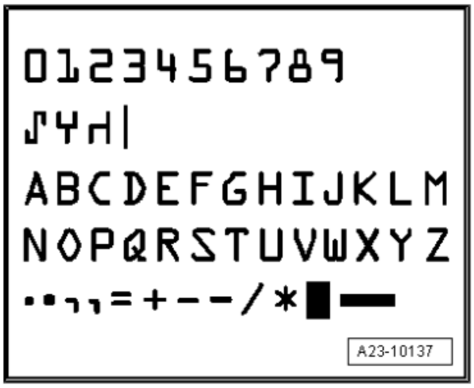
1.18 Adaption of injector delivery calibration values and injector voltage calibration values

The “Injector delivery calibration” and “Injector voltage calibration” functions serve to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.

The 7-digit adaption values -1- (details in illustration are only an example) are marked separately on each injector. They may consist of letters and/or numbers (ASCII code).



Reference table for reading out letters and/or numbers on each injector



After replacement of an injector, the “injector delivery calibration value” and “injector voltage calibration value” for the new injector must be written into the engine control unit.

After replacement of the engine control unit, the “injector delivery calibration values” and “injector voltage calibration values” for the injectors must be written into the new engine control unit.

The adaption procedure is described in the Guided Fault Finding. (The procedure is also described under Guided Functions.)

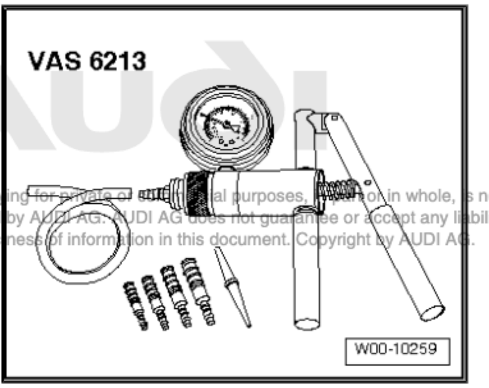
Additionally, check that the “injector delivery calibration values” with “injector voltage calibration values” are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

1.19 Checking for injectors sticking open (piezo injectors)

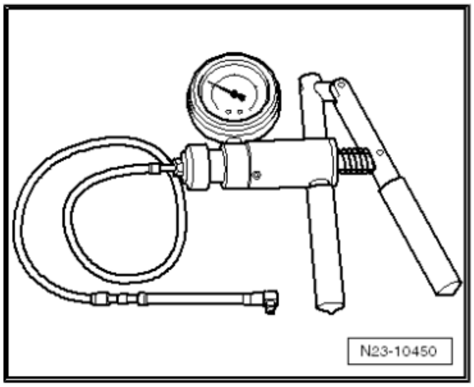
If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

Special tools and workshop equipment required

◆ Hand vacuum pump - VAS 6213-



◆ Use a return line to make an -adapter-.



Procedure

– Pull off engine cover panel ⇒ page 14 .

– Clean all fuel rail connections with engine cleaner or brake cleaner and dry.

WARNING

◆ *Always read instructions on ⇒ page 2 when working on injectors.*

◆ *Follow these instructions before starting work and while working on the fuel system.*

Check all cylinders in turn.

Starting with cylinder 1

- Disconnect fuel return hoses from injectors; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.

Note

Illustration shows cylinder bank 1.

- Connect adapter to return line connection of injector to be tested after adapter has been cleaned and blown out.
- Generate a vacuum of -500 mbar using the hand vacuum pump - VAS 6213- .

If the vacuum reading remains the same for 30 seconds, the injector is OK.

In the case of a faulty injector, the vacuum will fall back to 0 bar within 2 to 3 seconds.

Repeat test if necessary; note drop in vacuum reading on hand vacuum pump - VAS 6213- .

- Renew faulty injectors ⇒ page 52 .

Installing fuel return lines

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

Note

Lubricate all seals with engine oil or assembly oil before installing.

- Press the return lines firmly onto the injectors from above so that they engage audibly on each injector. Then re-fit the retaining clips. Check that the return lines are seated securely by pulling them by hand from above.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

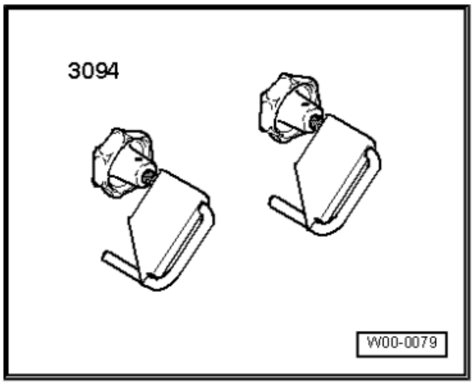
- Install engine cover panel ⇒ page 14 .

1.20 Measuring return flow rate of injectors with engine running

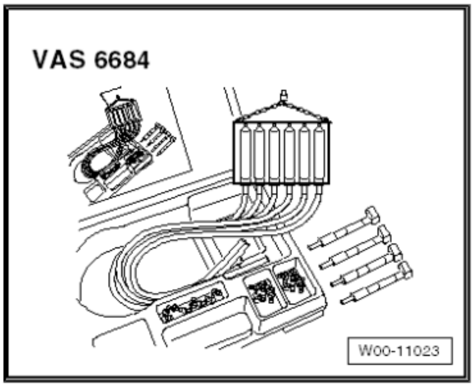
Checking return flow rate if engine does not start ⇒ page 49

Special tools and workshop equipment required

- Fuel-resistant measuring container
- Hose clamps, up to 25 mm - 3094-



- Return flow meter - VAS 6684-



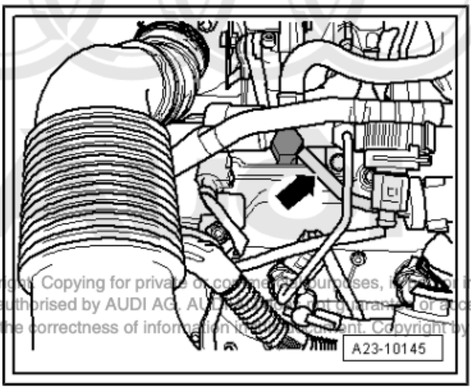
Checking return flow rate of all 6 injectors

– Remove engine cover panel ⇒ page 14 .

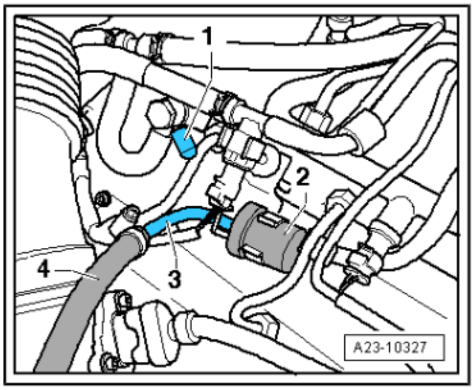
WARNING

- *Always read instructions on ⇒ page 2 when working on injectors.*
- *Follow these instructions before starting work and while working on the fuel system.*

– Disconnect hose connection -arrow- at banjo bolt connection.



- Seal off open return connection with plug -1-.
- Hold end of this hose -3- (lengthen with hose -4- if necessary) in a suitable container to measure total return flow rate.
- Start engine and let it idle for 2 minutes.
- Specification for 2 minutes: 0 ml to 50 ml
- If specification is attained, increase engine speed to 2000 ... 2500 rpm for approx. 2 minutes and then check return flow rate again.
- Specification for 2 minutes: less than 250 ml



Note

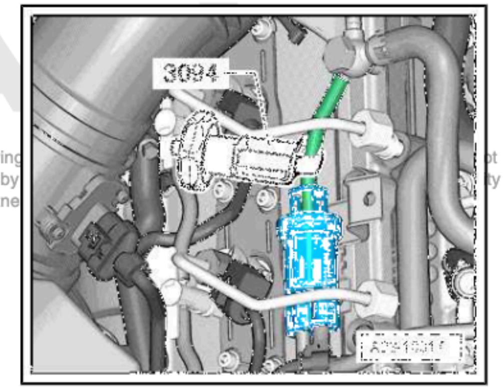
1000 ml = 1 litre

If specification is exceeded, this indicates that one or more injectors are defective. Check return flow rate from each injector individually.

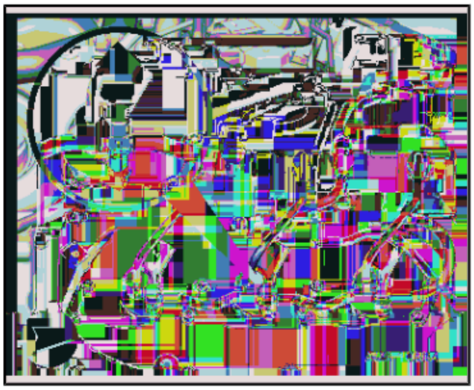
Checking return flow rate of individual injectors

Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

- Clean all return line connections (with commercial cleaning solution etc.) before removing.
- Dry all components after cleaning.
- Clamp off fuel return line downstream of pressure retention valve using hose clamp up to 25 mm - 3094- .

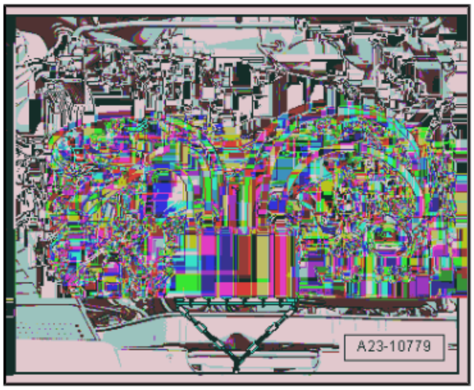


- Disconnect fuel return hoses from injectors on cylinder bank 1; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.



- Disconnect fuel return hoses from injectors on cylinder bank 2; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.

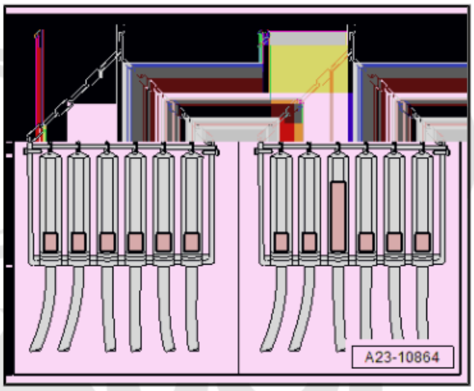
- Connect hoses of return flow meter - VAS 6684- to return line connections of all six injectors.
- Start engine and let it idle for several minutes.



> **Caution**
>
> *Risk of damage to injectors due to increased engine speed.*
>
> - *Do NOT press the accelerator during this test; the engine must only run at idling speed.*

- When the engine is warm and running at idling speed, the return flow rates at each of the 6 return lines must not differ by more than a small amount.

Evaluating return flow rate:



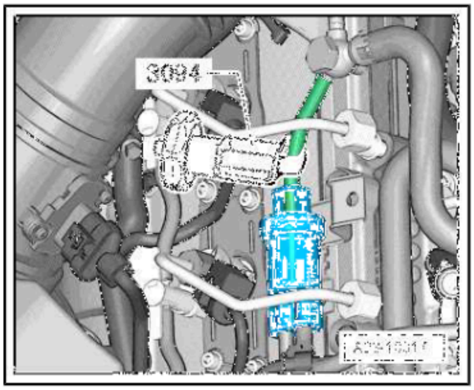
- 1 = injectors OK; return flow rate approx. identical on all injectors.
- 2 = injector for cylinder 3 not OK; return flow rate surpasses value three times the volume of smallest measured return flow rate.

Note

There is a mechanical fault at the injector if the return flow rate is greater than three times the volume of the smallest measured return flow rate.

- If one injector has a significantly higher return flow rate than the others it must be renewed ⇒ page 52 .

- Remove hose clamp up to 25 mm - 3094- from fuel return line.



Installing fuel return lines

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

Note

Lubricate all seals with engine oil or assembly oil before installing.

- Press the return lines firmly onto the injectors from above so that they engage audibly on each injector. Then re-fit the retaining clips. Check that the return lines are seated securely by pulling them by hand from above.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

Note

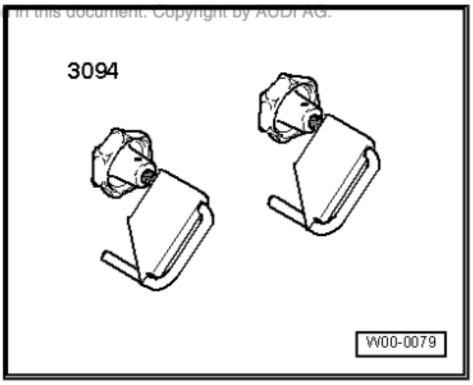
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

1.21 Checking return flow rate of injectors at starter cranking speed

Only perform this test if the engine does not start at all.

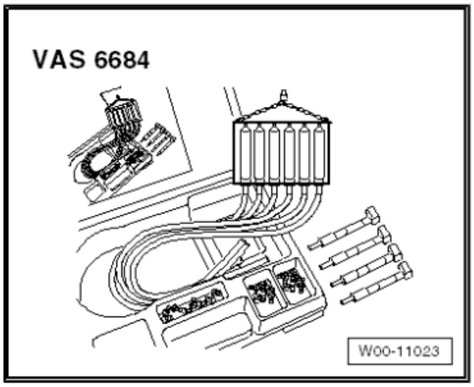
Special tools and workshop equipment required

- Hose clamps, up to 25 mm - 3094-



- Return flow meter - VAS 6684-

- 6 lengths of hose to fit return line connections on injectors



WARNING

- *Always read instructions on ⇒ page 2 when working on injectors.*
- *Follow these instructions before starting work and while working on the fuel system.*

Procedure

Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

– Remove engine cover panel ⇒ page 14 .

– Clean all return line connections with engine cleaner or brake cleaner and dry.

– Clamp off fuel return line downstream of pressure retention valve using hose clamp up to 25 mm - 3094- .

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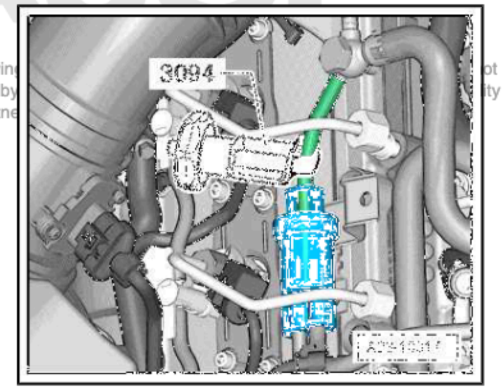
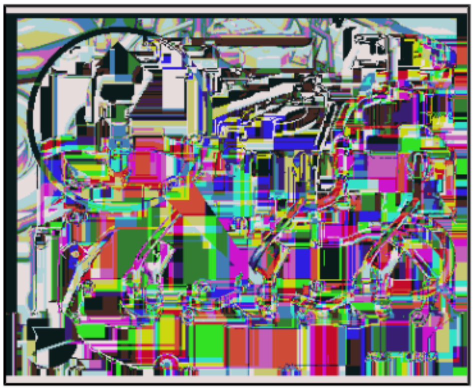
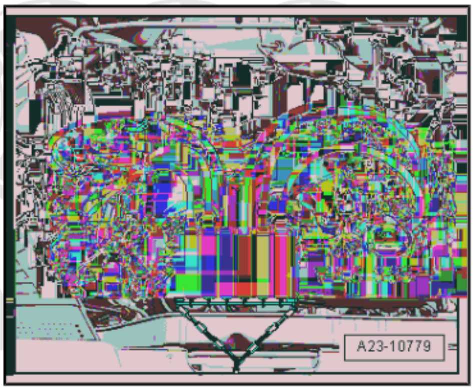


– Disconnect fuel return hoses from injectors on cylinder bank 1; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.



- Disconnect fuel return hoses from injectors on cylinder bank 2; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.



- Connect hoses of return flow meter - VAS 6684- to return line connections of all six injectors.
- Operate starter three times (wait approx. 20 seconds each time after operating starter to prevent it from overheating).

◆ Specification of return flow rate: 0 ml

- If fuel comes out of one injector, that injector must be renewed ⇒ page 52 .

Installing fuel return lines

- Check O-ring for fuel return line connection for damage and deformation.

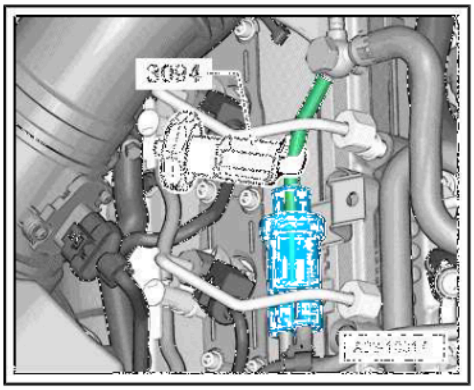
If O-ring is damaged or deformed, renew O-ring.

Note

Lubricate all seals with engine oil or assembly oil before installing.

- Press the return lines firmly onto the injectors from above so that they engage audibly on each injector. Then re-fit the retaining clips. Check that the return lines are seated securely by pulling them by hand from above.

- Remove hose clamp up to 25 mm - 3094- from fuel return line.



Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

1.22 Checking pressure retention valve in fuel return line

The pressure retention valve maintains a residual pressure of approx. 10 bar in the return lines.

This residual pressure is required for the control function of the piezo injectors.

Special tools and workshop equipment required

- Tester for fuel return system - 6330-

WARNING

- *Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .*
- *Follow these instructions and rules for cleanliness before starting work and while working on the fuel system.*

– Remove engine cover panel ⇒ page 14 .

– Clean return line connection on cylinder 1 (with commercial cleaning solution etc.) before removing.

– Dry return line connection on cylinder 1.

– Cover return line connection on cylinder 1 with a cloth.

– Pull return line connection off 1st cylinder; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.

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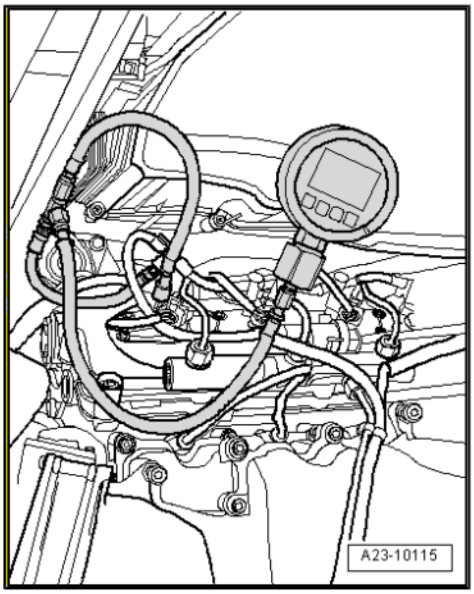
Note

Take care to keep all components clean. No dirt must be allowed to get into the disconnected return line or the open connection on the injector.



– Connect tester for fuel return system - 6330- between return line connection on injector and return line.

– Start engine.

– Check pressure indicated on tester.

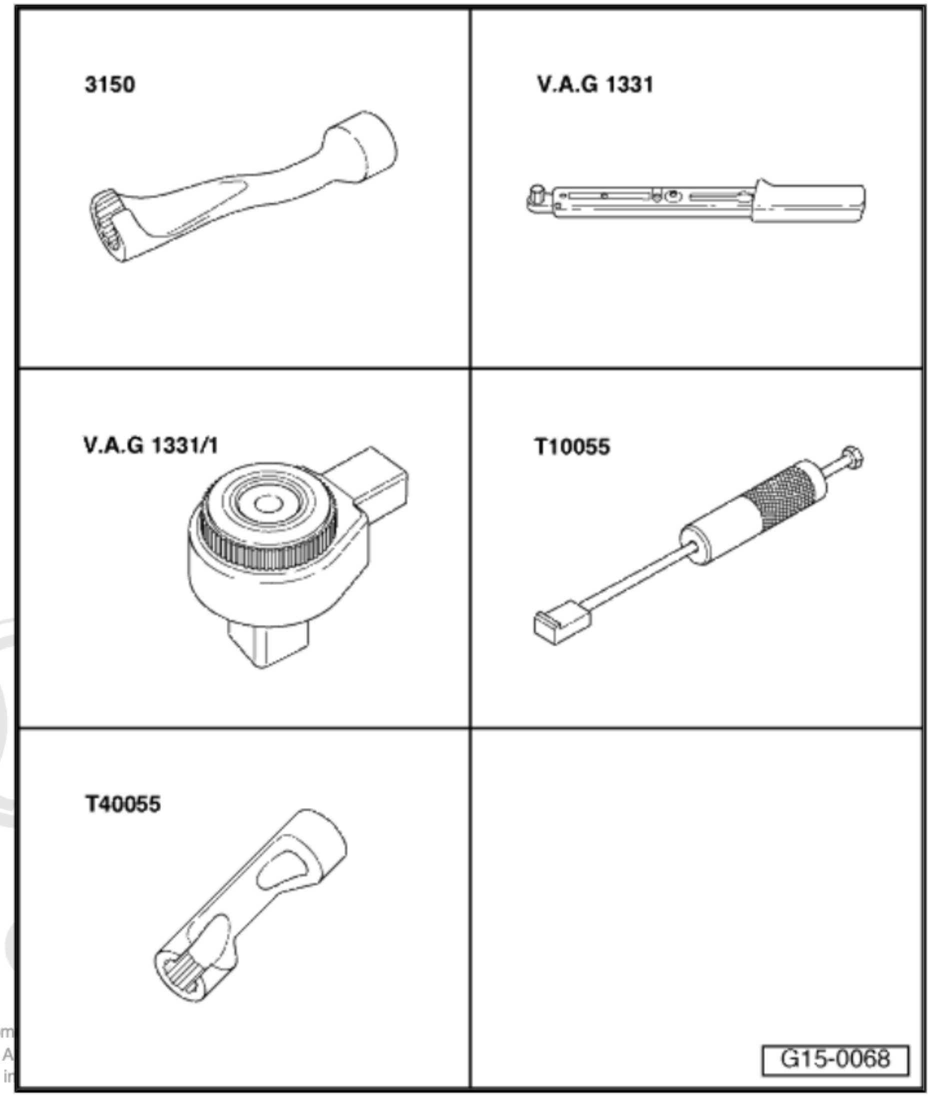
- Specification: approx. 10 bar

If the value does not match the specification, fit a new pressure retention valve.

1.23 Removing and installing injectors

Special tools and workshop equipment required

- Socket, 14 mm - 3150-
- Torque wrench - V.A.G 1331-
- Ratchet - V.A.G 1331/1-
- Puller - T10055- with adapter - T10055/1-
- Socket, 17 mm - T40055-
- Open end spanner insert, AF 19 - V.A.G 1331/5-
- Cleaning kit - VAS 6811-



Removing

WARNING

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

When a new injector is installed, the adaption value for the new injector must be written into the engine control unit. ⇒ page 43

Note

The following description shows the removal and installation of the injectors on cylinder bank 2 (left-side). The procedure for cylinder bank 1 is the same, except that some steps are not required.

– Remove engine cover panel ⇒ page 14 .

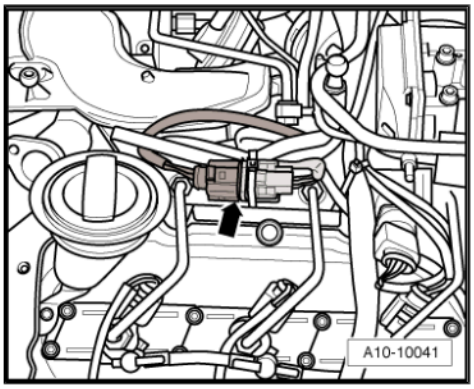
WARNING

Mark cylinder numbers on injector units.

Observe rules for cleanliness when working on the injection system.

Plug open connections with suitable sealing caps immediately.

– Step required only for cylinder bank 2: Open cable tie securing electrical connector -arrow- for Lambda probe - G39- .



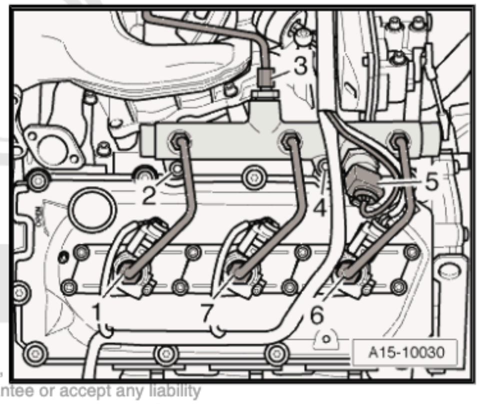
Note

Step required only for cylinder bank 1: Remove top section of air cleaner with air mass meter ⇒ page 16 .

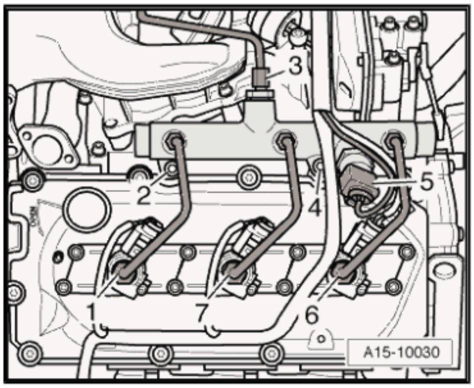
– Pull return line connections off injectors; to do so, press both tabs down and at the same time pull centre piece up to release connection -arrow-.

– Detach electrical connectors at injectors which are to be removed.

– Loosen union nuts for injector pipes -1-, -6- and -7- at injectors.

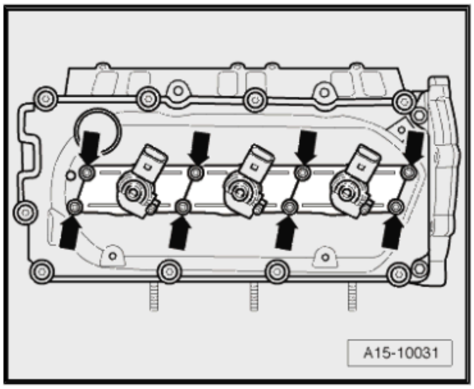


– Loosen union nuts for injector pipes -1-, -6- and -7- at rail element.

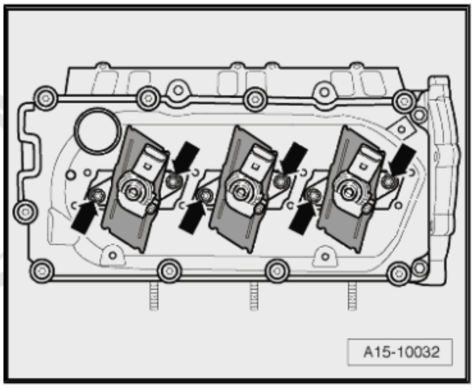


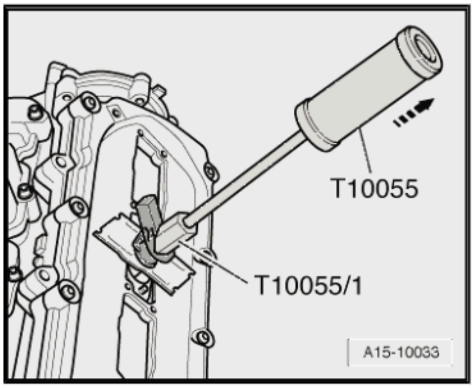
– Unbolt covers for injectors -arrows-.

– Pull covers upwards and turn them $^1/_4$ turn (90°).



– Unbolt clamping pieces for injectors -arrows-.





– Pull out injectors using puller - T10055- with adapter - T10055/1- .

– After removal, lay injectors on a clean cloth.

Important instructions for installing injectors:

◆ Clamping piece

◆ Copper seal

◆ O-ring for injector bore

◆ O-ring for fuel return line connection

If a used injector is being re-installed:

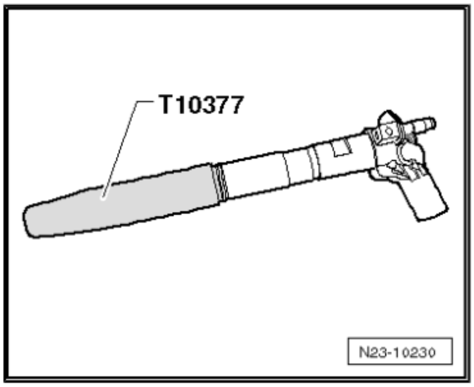
– Spray tip of injector nozzle with rust-releasing spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.

– To remove the old copper seal from the injector, clamp the seal carefully in a vice so that it is just held between the jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.

– Clean off deposits under the copper seal using a suitable scraper.

– Clean off deposits under the copper seal using a suitable scraper.

- Renew seal for injector using assembly sleeve - T10377- .
- To prevent damage to the new O-ring, lubricate it with oil and carefully push it onto the fuel return line connection.



Continued (same procedure for used and new injectors):

Note

Lubricate all O-rings with assembly oil, engine oil or diesel fuel before installing.

Caution

Risk of damage to injector sealing surface.

- *To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- .*

- Install injectors.

Note

- *Note identification marks for cylinder allocation when re-installing high-pressure pipes.*
- *The high-pressure pipes can be re-used after performing the following checks:*
- *Check taper seats of high-pressure pipes for deformation and cracks.*
- *The bore of the pipe must not be distorted, restricted or otherwise damaged.*
- *Corroded pipes must not be used again.*

- Tighten union nuts on high-pressure pipes and injector pipes hand-tight to start with.
- Ensure that high-pressure pipes and injector pipes are not under tension.
- Tighten union nuts to 25 Nm.
- Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.

After replacement of one or more injectors the “injector delivery calibration values” and “injector voltage calibration values” for the new injectors must be written into the engine control unit ⇒ page 43 .

Additionally, check that the “injector delivery calibration values” and “injector voltage calibration values” are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes and then switch off.

Note

The fuel system is self-bleeding; do not open the high-pressure connections.

- Switch off ignition.
- Carefully check the entire fuel system including all 6 return line connections for leaks (the fuel return lines can only be renewed together with the pressure retention valve as one unit).

Renew the affected component if leakage still occurs after tightening to the correct torque.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

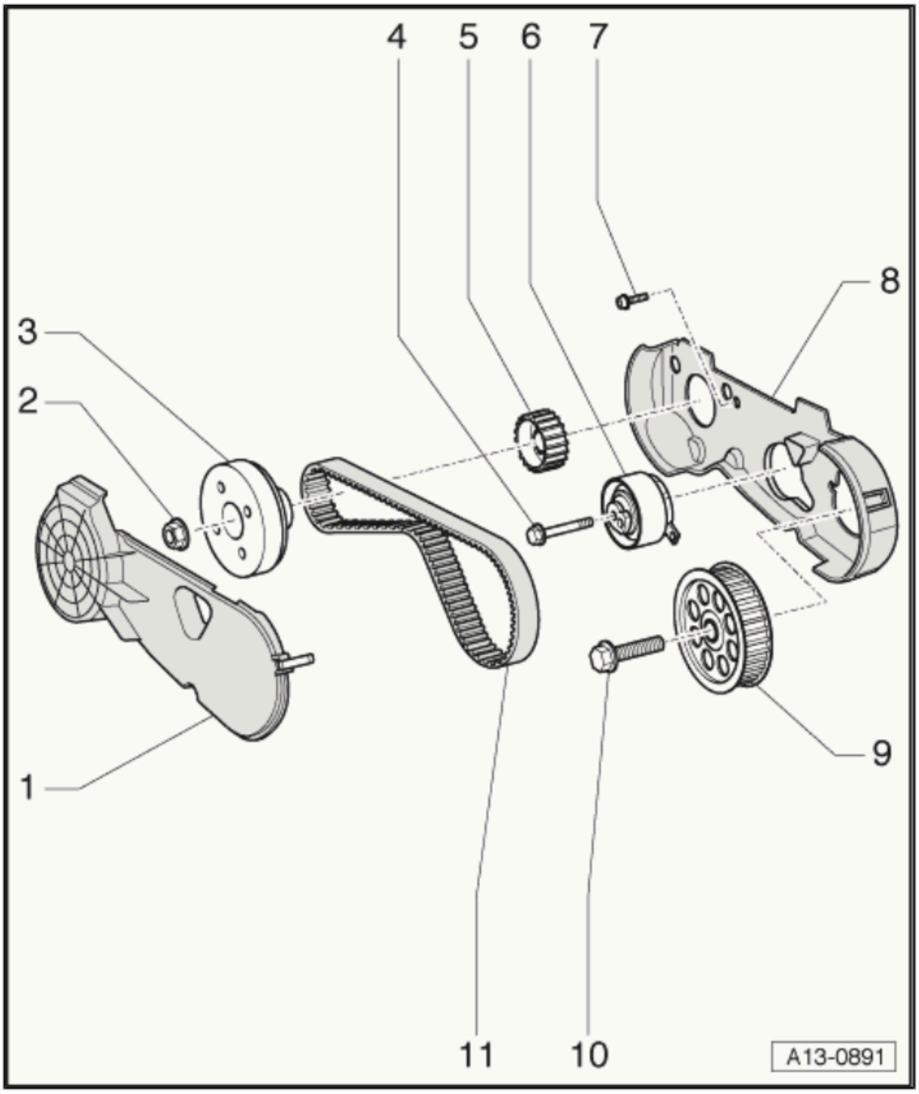
Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

Tightening torques

Component		Nm
Injector in cylinder head		10
Cover for injector to cylinder head		5
Rail element to cylinder head		22
High-pressure pipes and injector pipes		25
Bracket for intake connecting pipe to cylinder head		9
Intake connecting pipe to:	Intake manifold	9
	Bracket	9
Hose clips for air intake hose (13 mm wide)		5.5

1.24 Exploded view - toothed belt for high-pressure pump



1 - Toothed belt cover (front)

- ☐ Engage in position at the bottom at clip on at the side

2 - Nut

- ☐ 70 Nm
- ☐ Use counterhold tool - 3036- when loosening and tightening ⇒ page 60

3 - Damper weight

- ☐ Use counterhold tool - 3036- when loosening and tightening central nut ⇒ page 60

4 - Bolt

- ☐ 23 Nm

5 - Toothed belt sprocket for high-pressure pump

- ☐ Remove using puller - T40064- ⇒ page 60

6 - Toothed belt tensioning roller

7 - Bolt

- ☐ 9 Nm

8 - Toothed belt cover (rear)

9 - Toothed belt drive sprocket

- ☐ Use counterhold tool - 3036- when loosening and tightening central bolt ⇒ page 60
- ☐ Pulling off: up to 03.2006 ⇒ page 60 , from 03.2006 onwards ⇒ page 61

10 - Bolt

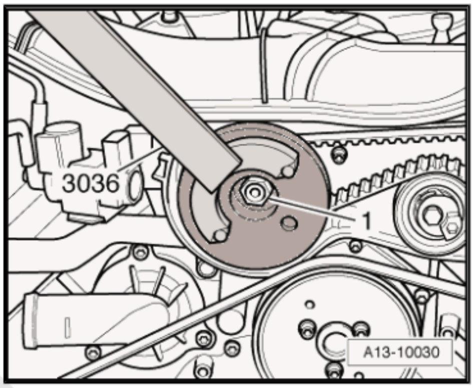
- ☐ 75 Nm
- ☐ With washer
- ☐ Use counterhold tool - 3036- when loosening and tightening ⇒ page 60

11 - Toothed belt for high-pressure pump

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ☐ Check for wear
- ☐ Removing and installing: vehicles up to 03.2006 ⇒ page 61 ; vehicles from 03.2006 onwards ⇒ page 65

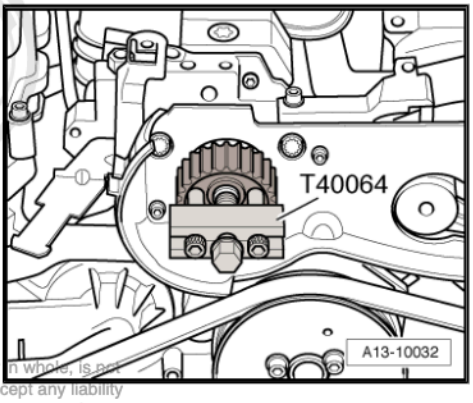
Loosening and tightening central nut for high-pressure pump

– Use counterhold tool - 3036- when loosening and tightening central nut -1-.



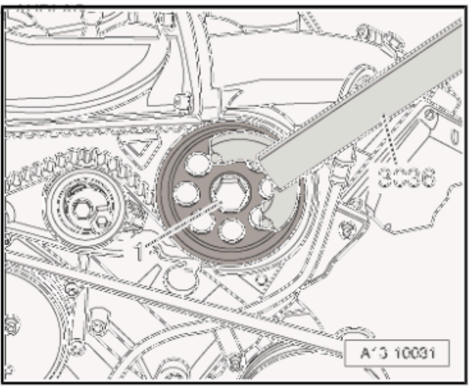
Pulling off toothed belt sprocket for high-pressure pump

– Use puller - T40064- to pull off belt sprocket for high-pressure pump.



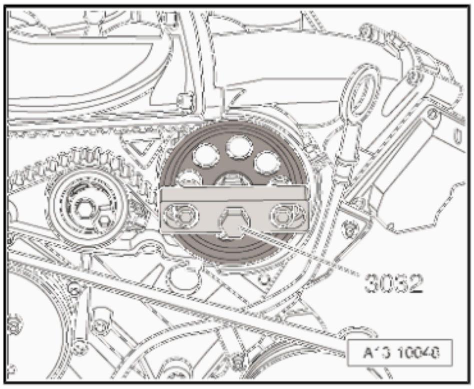
Loosening and tightening central bolt for toothed belt drive sprocket

– Use counterhold tool - 3036- when loosening and tightening central bolt -1-.



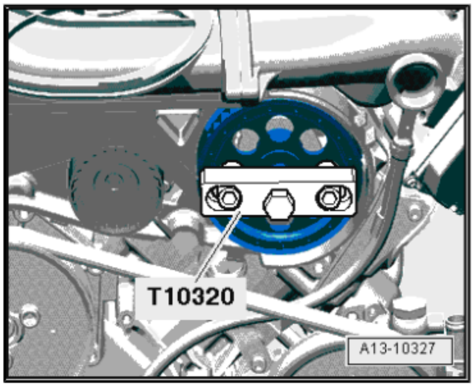
Pulling off toothed belt drive sprocket (versions up to 03.2006)

– Use puller - 3032- to pull off toothed belt drive sprocket.



Pulling off toothed belt drive sprocket (versions from 03.2006 onwards)

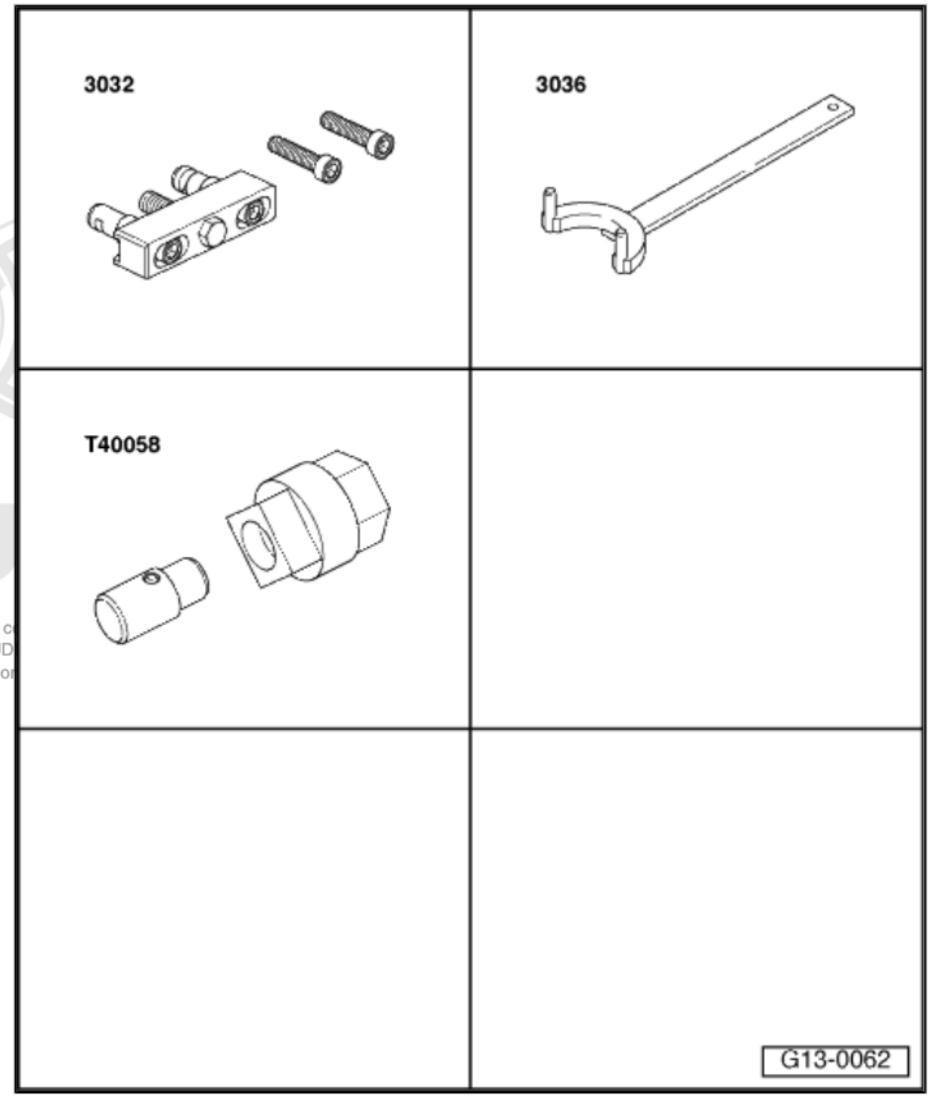
– Use puller - T10320- to pull off toothed belt drive sprocket.



1.25 Removing and installing toothed belt for high-pressure pump - vehicles up to 03.2006

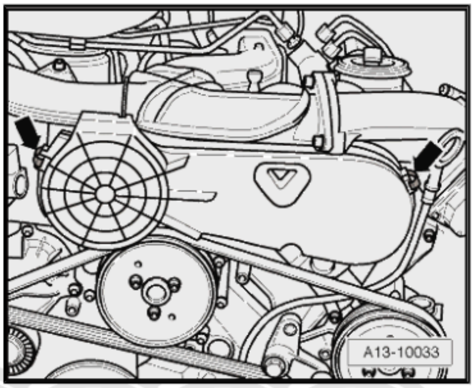
Special tools and workshop equipment required

- Puller - 3032-
- Counterhold tool - 3036-
- Adapter - T40058-



Removing

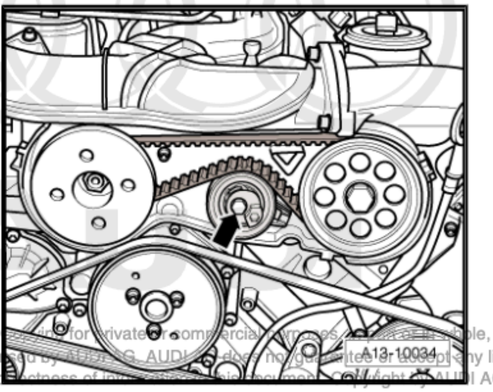
- Move lock carrier to service position ⇒ Rep. gr. 50 .
- Loosen clamps -arrows-.
- Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.



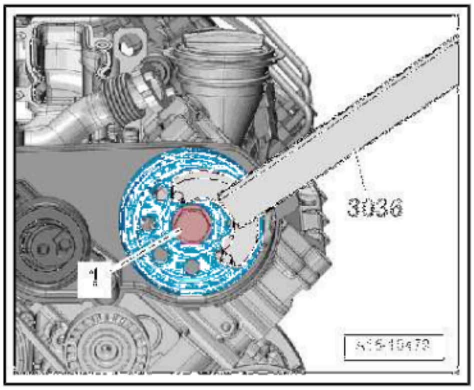
Note

Before removing, mark rotation direction of toothed belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Loosen bolt -arrow- for toothed belt tensioning roller approx. 2 turns.



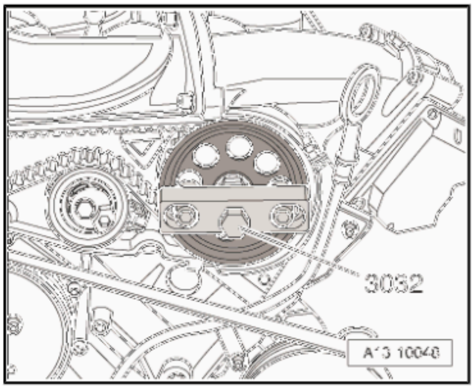
- Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool - 3036- .



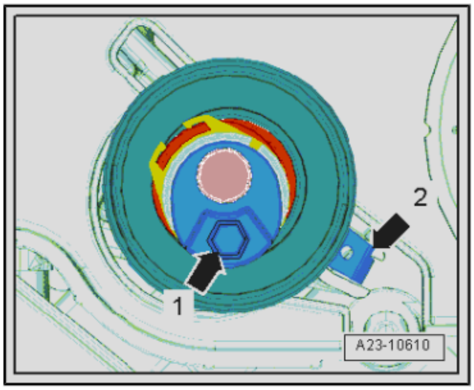
- Use puller - 3032- to pull off toothed belt drive sprocket.
- Take off drive sprocket together with toothed belt.

Installing

Installation is carried out in the reverse order; note the following:

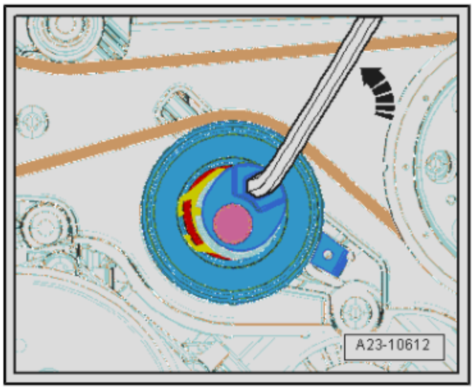


- Check installation position of toothed belt tensioning roller:
- Retaining lug -arrow 2- must engage in slot on bracket for high-pressure pump.
- Tensioning roller must be slack and hexagon socket -arrow 1- must face downwards.
- Fit toothed belt together with toothed belt drive sprocket.
- Install toothed belt tensioning roller; to do so, screw in bolt for toothed belt tensioning roller without applying force until eccentric adjuster of toothed belt tensioning roller can just still be turned without axial movement.
- Screw in bolt for toothed belt drive sprocket until toothed belt drive sprocket can just still be turned without axial movement.

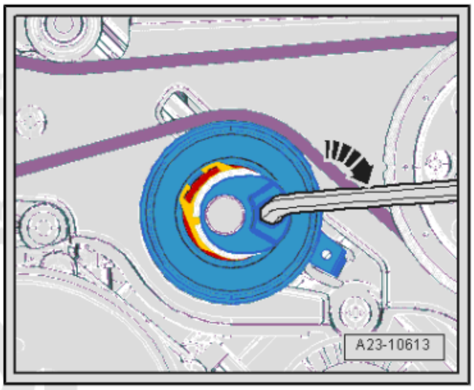


- Tension toothed belt tensioning roller slightly by turning in direction of -arrow- using hexagon key until hexagon socket is in "1 o'clock" position.

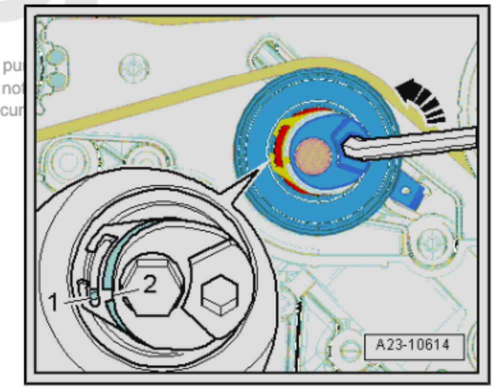
> **Caution**
>
> *Do NOT turn tensioning roller up to or beyond “12 o'clock” position.*



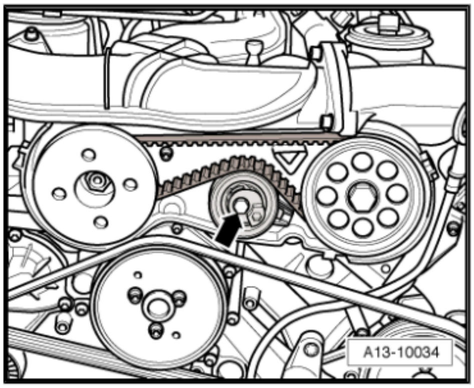
- Now release toothed belt tensioning roller -arrow- to such an extent that hexagon socket moves into "3 o'clock" position.



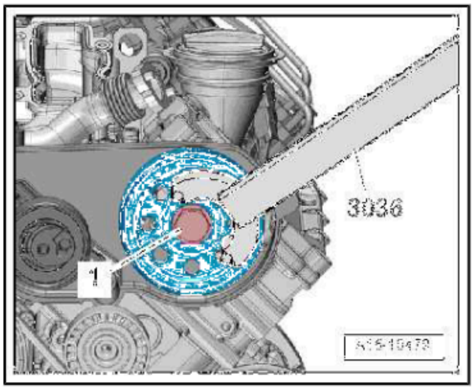
- Tension tensioning roller slightly from "3 o'clock" position -arrow- until lug -1- and notch -2- are exactly in line.



- Hold toothed belt tensioning roller in this position and tighten bolt -arrow- ⇒ Item 4 (page 59) .

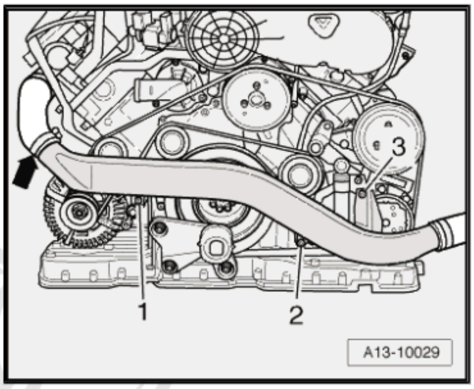


- Tighten bolt -1- for toothed belt drive sprocket using counter-hold tool - 3036- ⇒ Item 10 (page 59) .

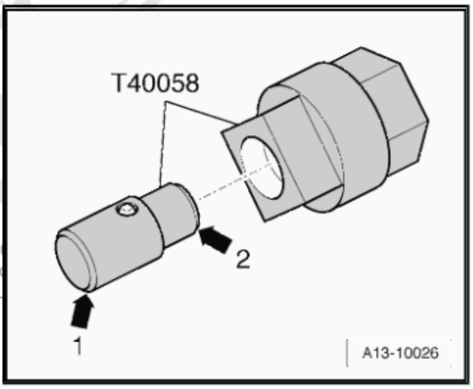


Turn crankshaft one complete revolution to check toothed belt tension. To do this:

- Disconnect air intake hose -arrow- from air pipe (top).
- Unscrew bolts -1 ... 3- and detach air pipe (top).

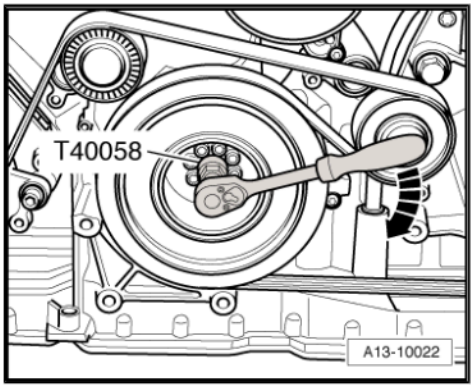


- Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.

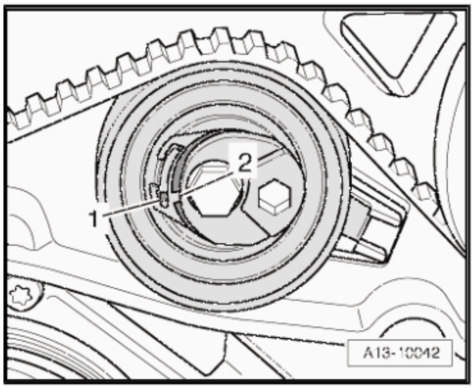


Caution

Do not rotate crankshaft in opposite direction of engine rotation.



– Turn crankshaft at least one complete revolution in normal running direction -arrow-.



– Check toothed belt tension.

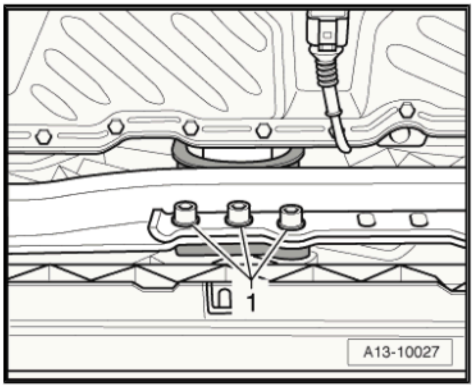
- Lug -1- should align with notch -2-.

If specification is not obtained:

– Adjust the toothed belt tension again.

Installation is carried out in the reverse order; note the following:

– Install lock carrier with attachments ⇒ Rep. gr. 50 .



– Slacken bolts -1-.

– Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.

– Install bumper cover (front) ⇒ Rep. gr. 63 .

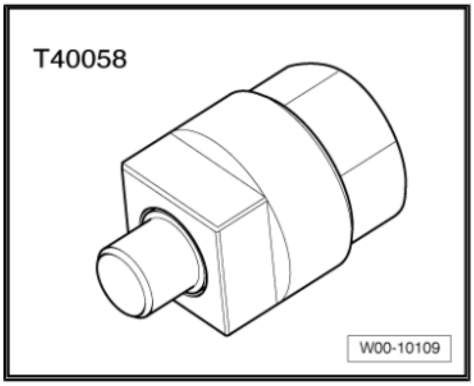
Tightening torques

Component		Nm
Toothed belt drive sprocket to camshaft	M14	75
	M10	75
Toothed belt tensioning roller to front bracket		23
Air pipe (top) to engine		9
Stop for torque reaction support to tubular cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

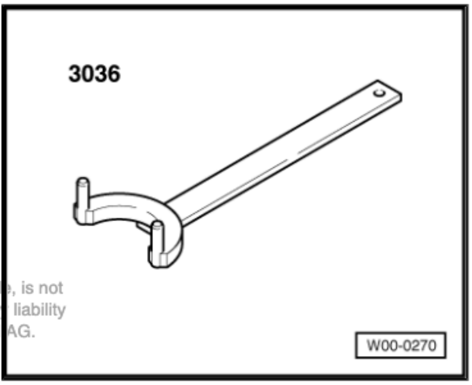
1.26 Removing and installing toothed belt for high-pressure pump - vehicles from 03.2006 onwards

Special tools and workshop equipment required

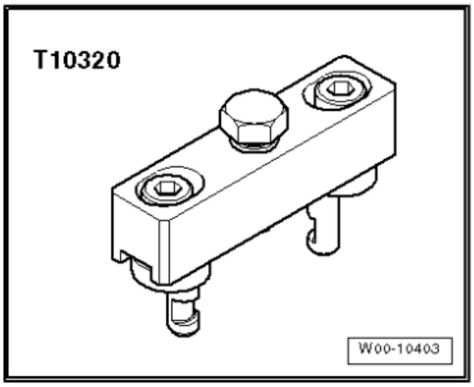
- Adapter - T40058-



- Counterhold tool - 3036-



- Puller - T10320-

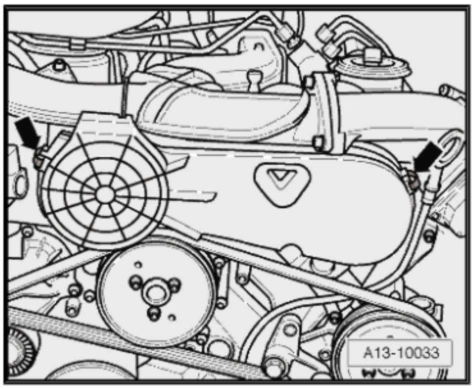


Removing

– Move lock carrier to service position ⇒ Rep. gr. 50 .

– Loosen clamps -arrows-.

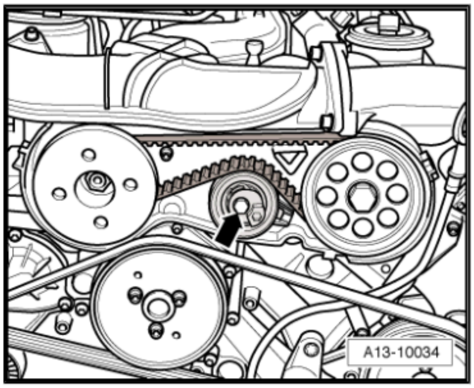
– Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.



Note

Before removing, mark rotation direction of toothed belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- Unscrew bolt -arrow- and detach tensioning roller.
- Take off toothed belt first from toothed belt drive sprocket and then from toothed belt sprocket at high-pressure pump.

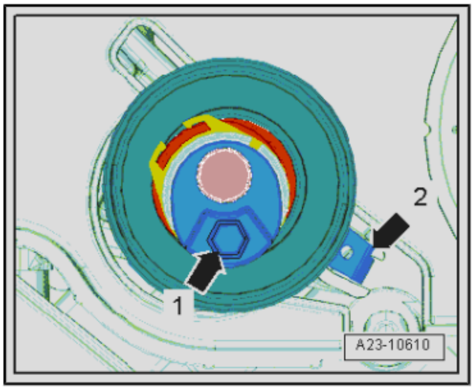


Installing

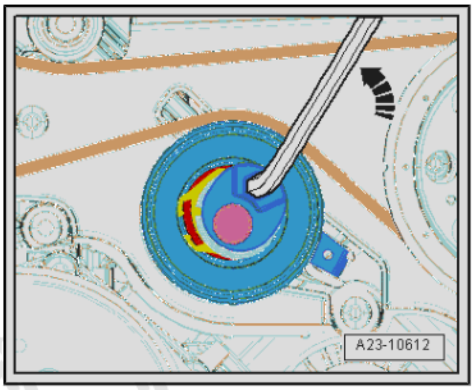
Installation is carried out in the reverse order; note the following:

Note

Before installing toothed belt make sure high-pressure pump and toothed belt sprockets are firmly in position.



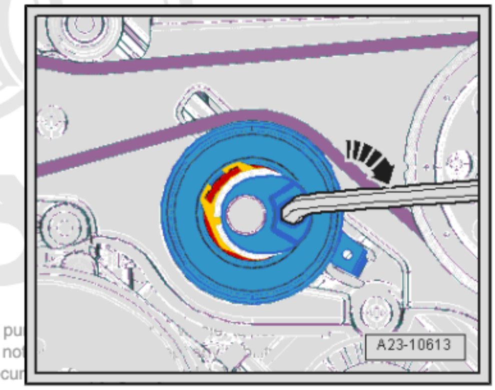
- Check installation position of toothed belt tensioning roller:
- Retaining lug -arrow 2- must engage in slot on bracket for high-pressure pump.
- Tensioning roller must be slack and hexagon socket -arrow 1- must face downwards.
- Fit toothed belt.
- Install toothed belt tensioning roller; to do so, screw in bolt for toothed belt tensioning roller without applying force until eccentric adjuster of toothed belt tensioning roller can just still be turned without axial movement.



- Tension toothed belt tensioning roller slightly by turning further in direction of -arrow- using hexagon key until hexagon socket is in "1 o'clock" position.

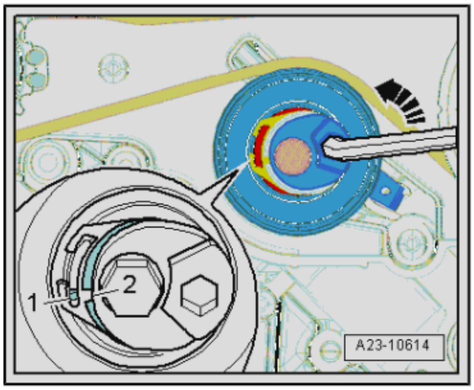
Caution

Do NOT turn tensioning roller up to or beyond “12 o'clock” position.

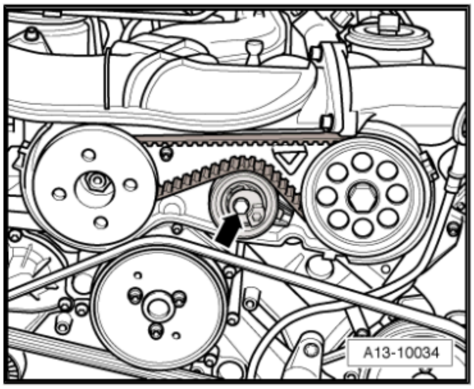


- Now release toothed belt tensioning roller -arrow- to such an extent that hexagon socket moves into "3 o'clock" position.

- Tension tensioning roller slightly from "3 o'clock" position -arrow- until lug -1- and notch -2- are exactly in line.

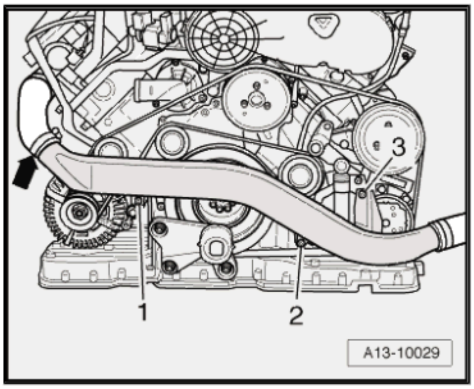


- Hold toothed belt tensioning roller in this position and tighten bolt -arrow- ⇒ Item 4 (page 59) .

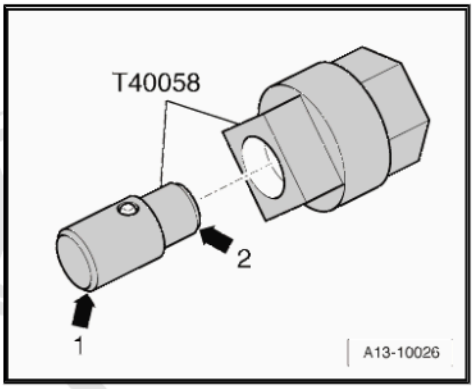


Turn crankshaft one complete revolution to check toothed belt tension. To do this:

- Disconnect air intake hose -arrow- from air pipe (top).
- Unscrew bolts -1 ... 3- and detach air pipe (top).

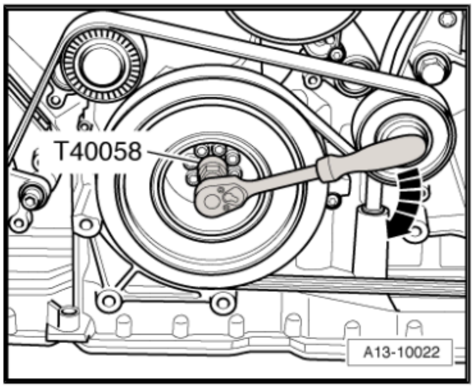


- Insert guide pin of adapter -T40058- with the larger-diameter section -arrow 1- pointing towards the engine. The smaller-diameter section -arrow 2- faces the adapter.

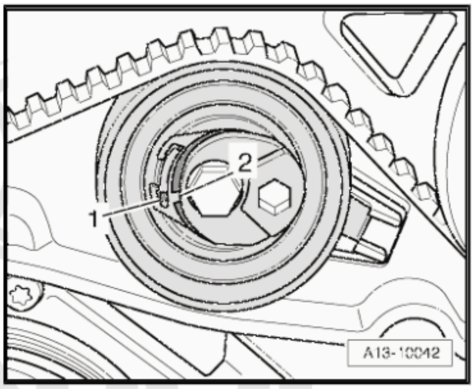


Caution

Do not rotate crankshaft in opposite direction of engine rotation.



- – Turn crankshaft at least one complete revolution in normal running direction -arrow-.



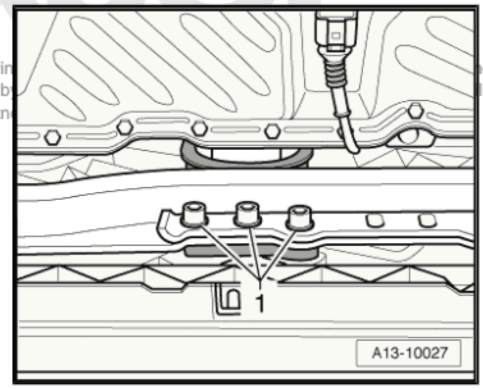
- – Check toothed belt tension.
- • Lug -1- should align with notch -2-.

If specification is not obtained:

- – Adjust the toothed belt tension again.

Installation is carried out in the reverse order; note the following:

- – Install lock carrier with attachments ⇒ Rep. gr. 50 .



- – Slacken bolts -1-.
- – Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- – Install bumper cover (front) ⇒ Rep. gr. 63 .

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Tightening torque

Component		Nm
Toothed belt tensioning roller to front bracket		23
Air pipe (top) to engine		9
Stop for torque reaction support to tubular cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.27 Exploded view - high-pressure pump on vehicles up to 08.2005

1 - Damper weight

- ☐ Use counterhold tool - 3036- when loosening and tightening central nut ⇒ page 71

2 - Nut

- ☐ 70 Nm
- ☐ Use counterhold tool - 3036- when loosening and tightening ⇒ page 71

3 - Toothed belt sprocket for high-pressure pump

- ☐ Remove using puller - T40064- ⇒ page 71

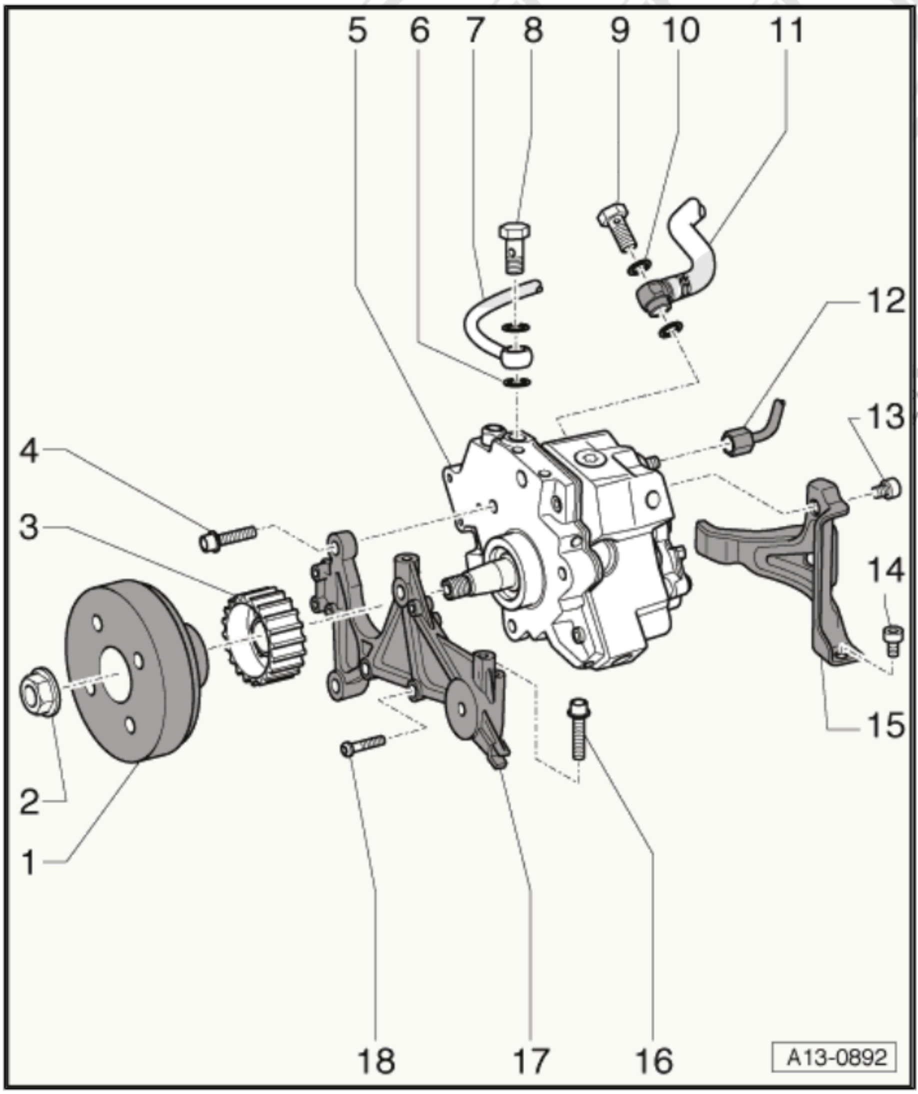
4 - Bolt

- ☐ 22 Nm

5 - High-pressure pump

> **Caution**
>
> *Observe rules for cleanliness when working on the injection system ⇒ page 2 .*
>
> *The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty.*

- ☐ Removing and installing ⇒ page 72
- ☐ Fuel system must be bled after installing high-pressure pump ⇒ page 83 .



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6 - Seals

- ☐ Renew

7 - Fuel supply line

8 - Banjo bolt

- ☐ 25 Nm

9 - Banjo bolt

- ☐ 25 Nm

10 - Seals

- ☐ Renew

11 - Fuel return line

12 - Union nut for high-pressure pipe

- ☐ 25 Nm
- ☐ Use socket insert AF 14, flared ring spanner - V.A.G 1331/8- to tighten ⇒ page 71

13 - Bolt

- ☐ 22 Nm

14 - Bolt

- ☐ 22 Nm

15 - Bracket for high-pressure pump

16 - Bolt

- ☐ 22 Nm

17 - Front bracket for high-pressure pump

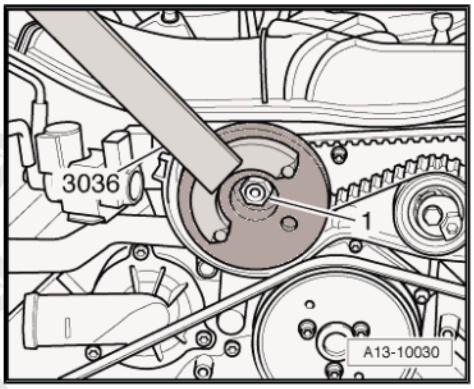
18 - Bolt

- ☐

9 Nm

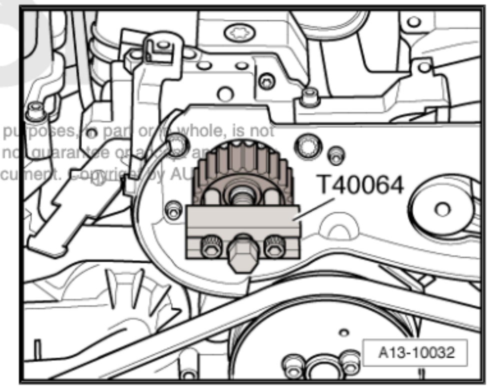
Loosening and tightening central nut for high-pressure pump shaft

– Use counterhold tool - 3036- when loosening and tightening central nut -1-.



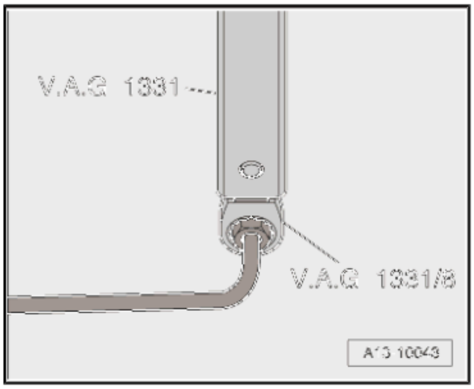
Pulling off toothed belt sprocket for high-pressure pump

– Use puller - T40064- to pull off belt sprocket for high-pressure pump.



Tightening union nut for high-pressure pipe at high-pressure pump

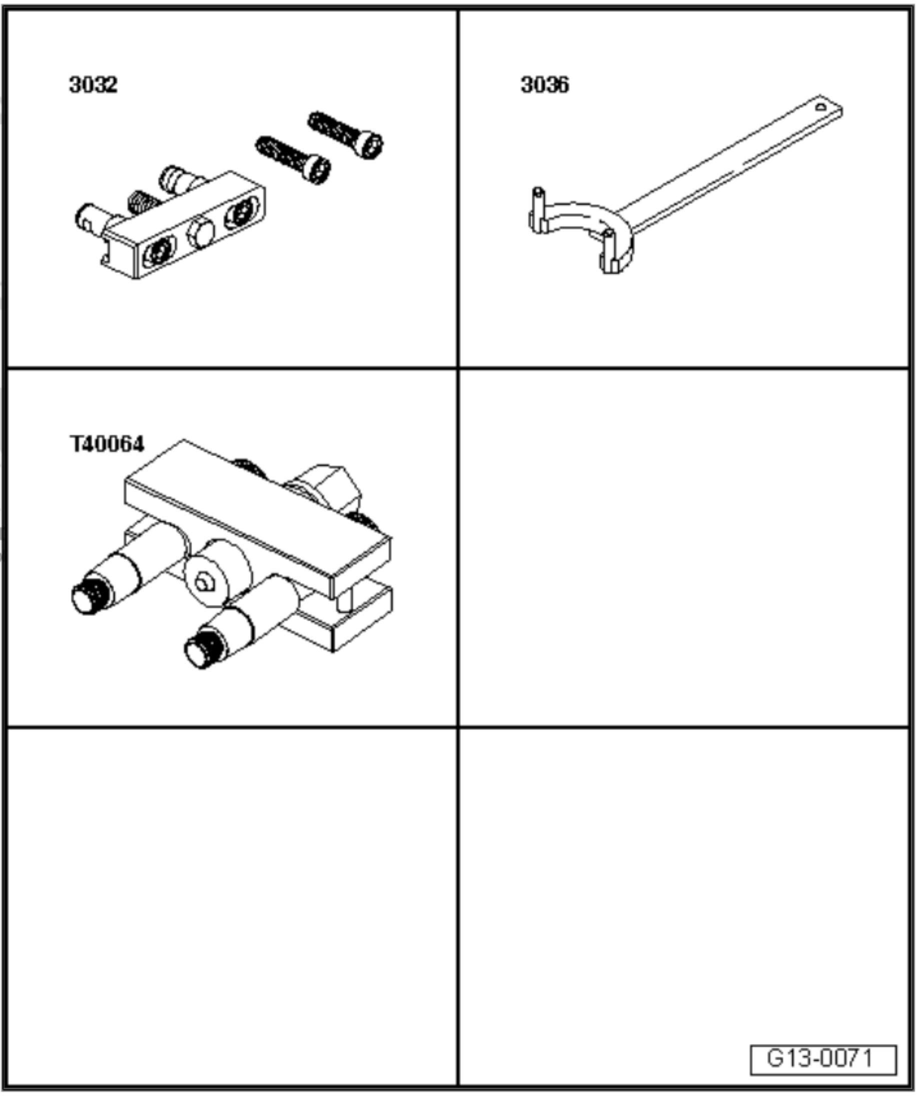
– Use socket insert AF 14, flared ring spanner - V.A.G 1331/8- for tightening.



1.28 Removing and installing high-pressure pump - vehicles up to 08.2005

Special tools and workshop equipment required

- Puller - 3032-
- Counterhold tool - 3036-
- Puller - T40064-

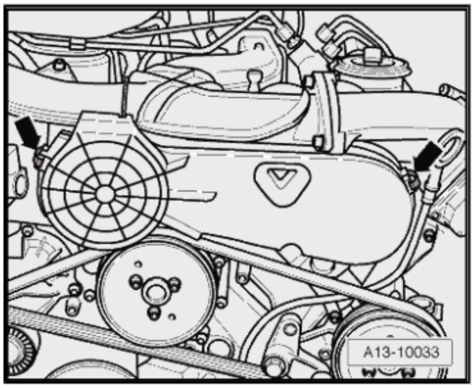


Removing

> **Caution**
>
> *Observe rules for cleanliness when working on the injection system ⇒ page 2 .*

– Move lock carrier to service position ⇒ Rep. gr. 50 .

– Remove intake manifold (top section) ⇒ page 20 .

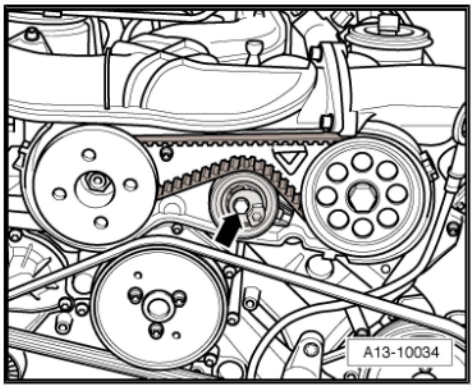


- Loosen clamps -arrows-.
- Pivot toothed belt cover forward and disengage retaining pegs on bottom side of toothed belt cover.

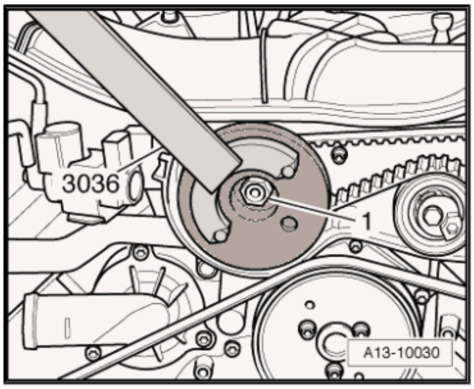
Note

Before removing, mark rotation direction of toothed belt with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

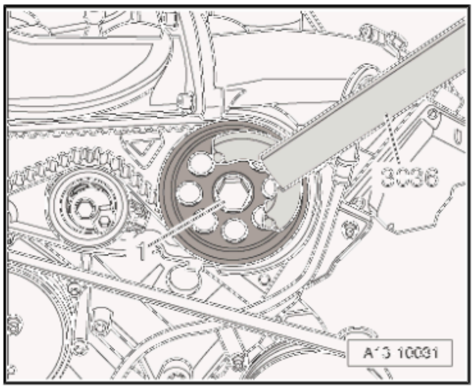
- Remove bottom section of intake manifold (left-side): vehicles up to 10.2004 ⇒ page 21 ; vehicles from 10.2004 onwards ⇒ page 25 .



- Remove bolt -arrow- for tensioning roller and take off tensioning roller.

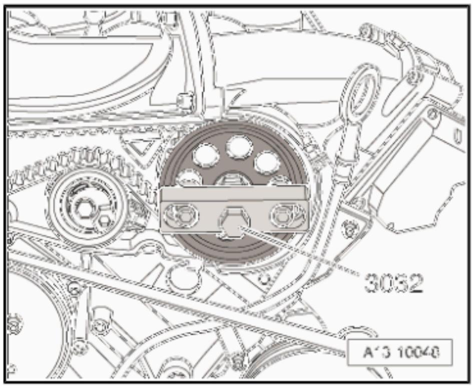


- Loosen central nut -1- for high-pressure pump shaft using counterhold tool - 3036- .
- Remove damper weight.

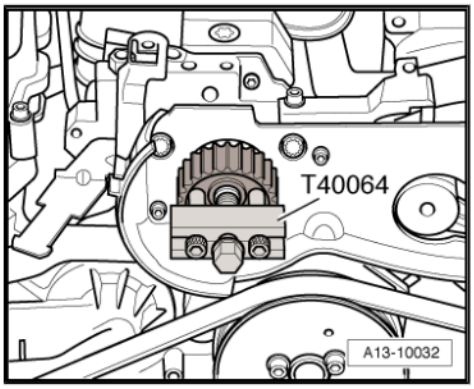


- Loosen central bolt -1- for toothed belt drive sprocket approx. 2 turns using counterhold tool - 3036- .

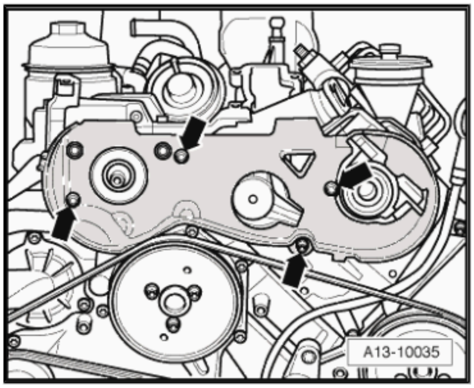
- Use puller - 3032- to pull off toothed belt drive sprocket.
- Take off toothed belt drive sprocket together with toothed belt.



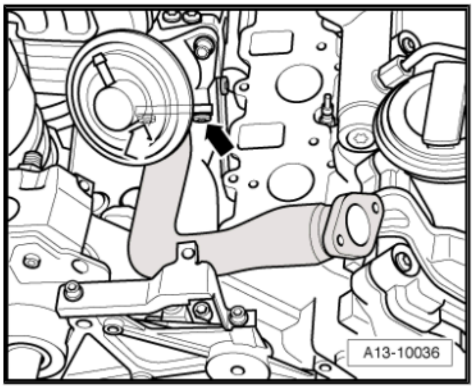
- Use puller - T40064- to pull off belt sprocket for high-pressure pump.



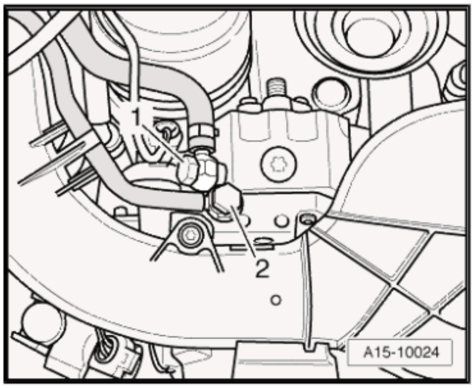
- Remove bolts -arrows- and detach toothed belt cover (rear).



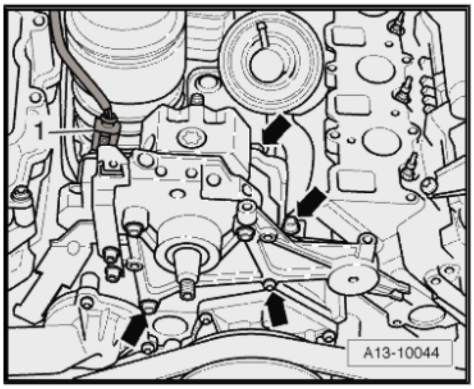
- Remove bolts -arrows- and take off connecting pipe for exhaust gas recirculation.



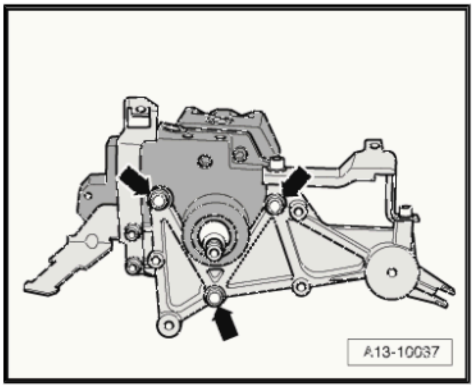
- Disconnect fuel supply line -2- and fuel return line -1- from high-pressure pump and move lines clear to the side.



- Unplug electrical connector -1-.
- Remove bolts -arrows-.
- Take off high-pressure pump together with front bracket.



- Remove bolts -arrows-.
- Detach front bracket from high-pressure pump.



Installing

Installation is carried out in the reverse order; note the following:

Caution

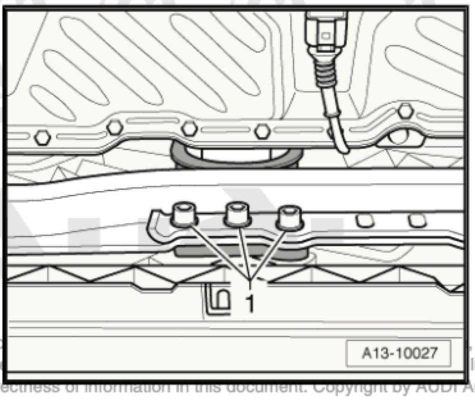
The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty.

Note

Renew gaskets and seals.

- Install toothed belt for high-pressure pump ⇒ page 61 .
- Install bottom section of intake manifold (left-side): vehicles up to 10.2004 ⇒ page 21 ; vehicles from 10.2004 onwards ⇒ page 25 .
- Install intake manifold (top section) ⇒ page 20 .
- Install lock carrier with attachments ⇒ Rep. gr. 50 .

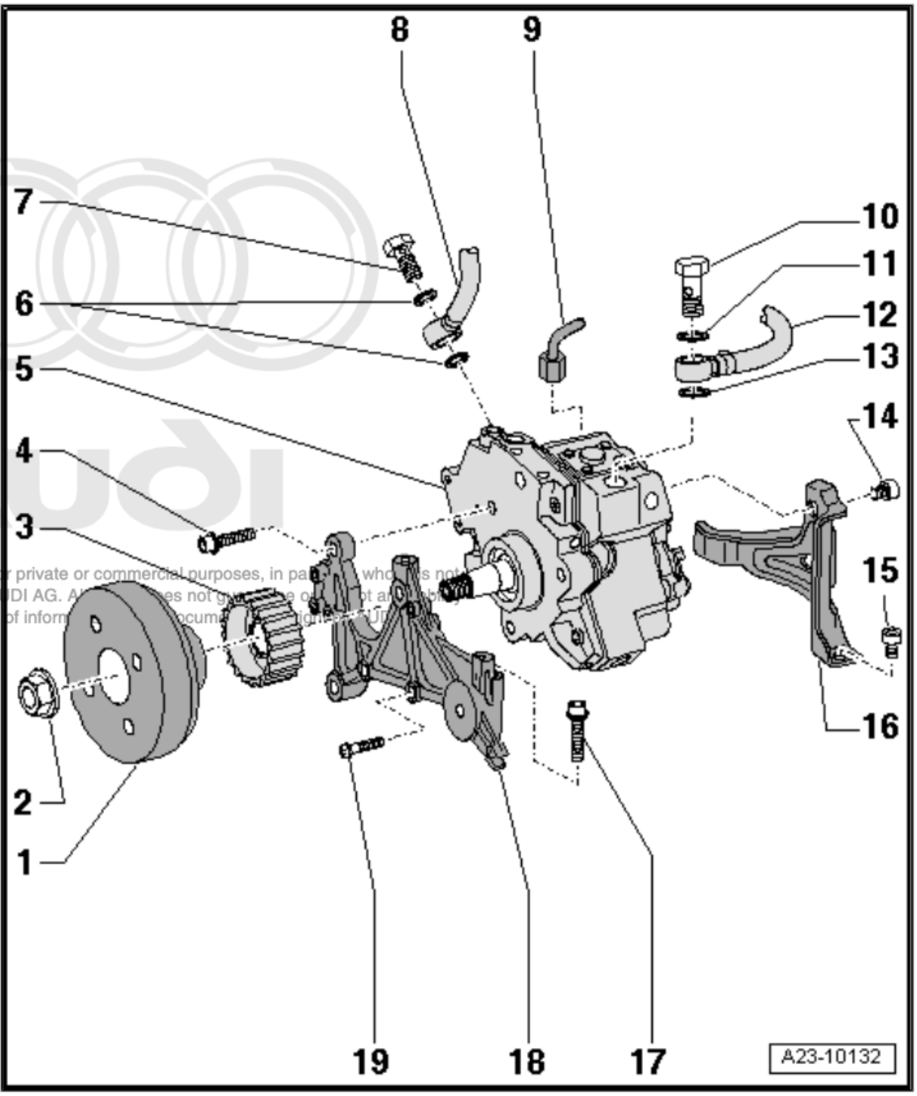
- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Check fuel system for leaks ⇒ page 83 .



Tightening torques

Component		Nm
Front bracket to high-pressure pump		22
High-pressure pump with front bracket to bracket (rear)		22
High-pressure pump with front bracket to engine	M6	9
	M8	22
Fuel supply and return lines to high-pressure pump		25
EGR connecting pipe to exhaust gas recirculation valve - N18-		9
Toothed belt cover (rear) to engine		9
High-pressure pipe to high-pressure pump		25
Air pipe (top) to engine		9
Stop for torque reaction support to tubular cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.29 Exploded view - high-pressure pump on vehicles from 08.2005 onwards



1 - Damper weight

- ☐ Use counterhold tool -3036- when loosening and tightening central nut ⇒ page 78

2 - Nut

- ☐ 70 Nm
- ☐ Use counterhold tool -3036- when loosening and tightening ⇒ page 78

3 - Toothed belt sprocket for high-pressure pump

- ☐ Remove using puller -T40064- ⇒ page 78

4 - Bolt

- ☐ 22 Nm

5 - High-pressure pump

> Caution
>
> *Observe rules for cleanliness when working on the injection system ⇒ page 2 .*
>
> *The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty.*

- ☐ Removing and installing ⇒ page 79
- ☐ Fuel system must be bled after installing high-pressure pump ⇒ page 83 .

6 - Seals

- ☐ Renew

7 - Banjo bolt

- ☐ 25 Nm

8 - Fuel supply line

9 - Union nut for high-pressure pipe

- ☐ Tighten to 25 Nm
- ☐ Use socket - T40055- , 17 mm to tighten ⇒ page 78

10 - Banjo bolt

- ☐ 25 Nm

11 - Seal

- ☐ Renew

12 - Fuel return line

13 - Seal

- ☐ Renew

14 - Bolt

- ☐ 22 Nm

15 - Bolt

- ☐ 22 Nm

16 - Bracket for high-pressure pump

17 - Bolt

- ☐ 22 Nm

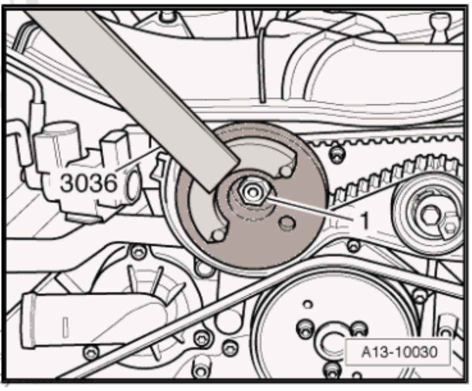
18 - Front bracket for high-pressure pump

19 - Bolt

- ☐ 9 Nm

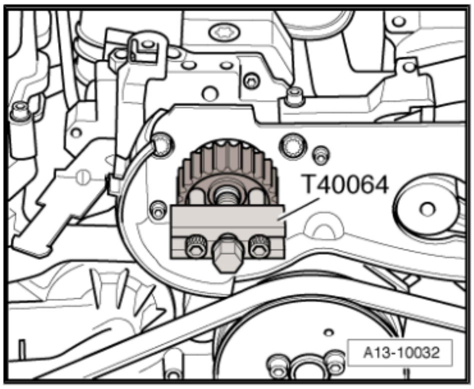
Loosening and tightening central nut for high-pressure pump shaft

– Use counterhold tool - 3036- when loosening and tightening central nut -1-.



Pulling off toothed belt sprocket for high-pressure pump

– Use puller - T40064- to pull off belt sprocket for high-pressure pump.

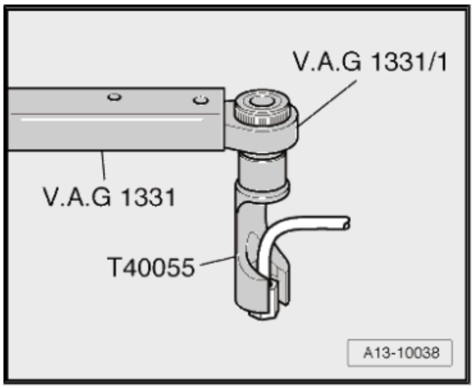


Tightening high-pressure pipe at high-pressure pump

– Tighten union nut on high-pressure pipe hand-tight initially.

– Ensure that high-pressure pipe is not under tension.

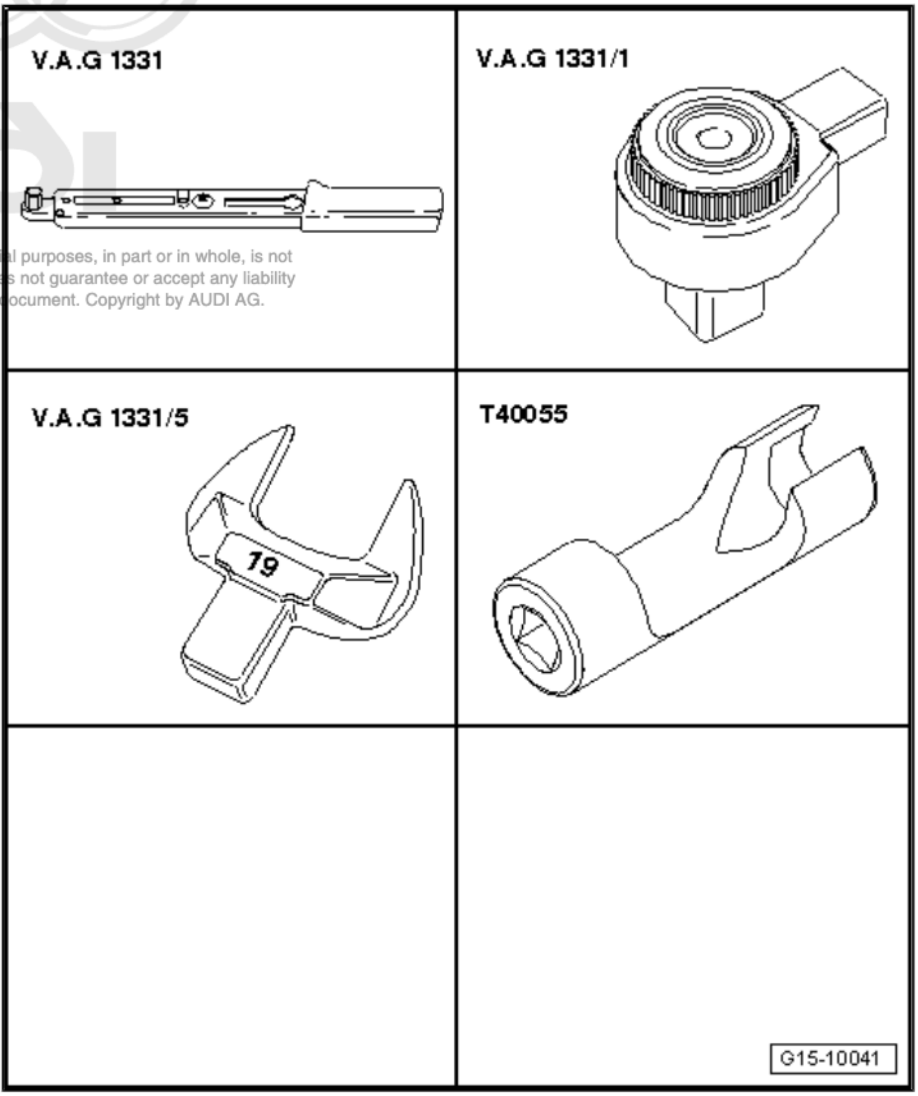
– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- , 17 mm.



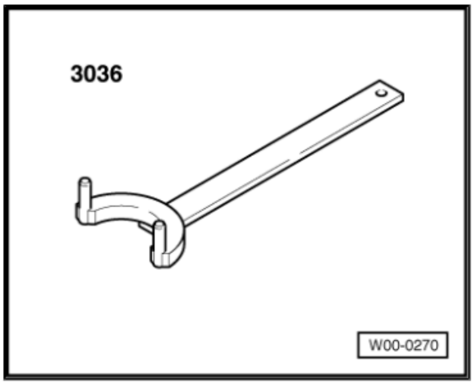
1.30 Removing and installing high-pressure pump - vehicles from 08.2005 onwards

Special tools and workshop equipment required

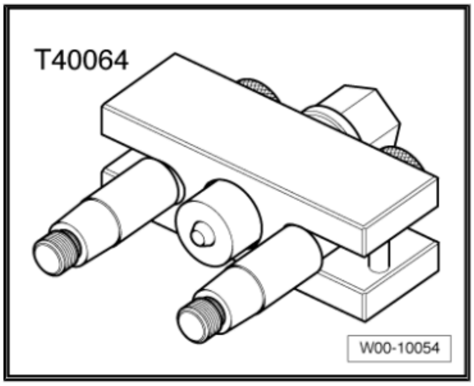
- Torque wrench - V.A.G 1331-
- Open end spanner insert, AF 19 - V.A.G 1331/5-
- Ratchet - V.A.G 1331/1-
- Socket - T40055- (17 mm)



- Counterhold tool - 3036-



- Puller - T40064-



Removing

– Move lock carrier to service position ⇒ Rep. gr. 50 .

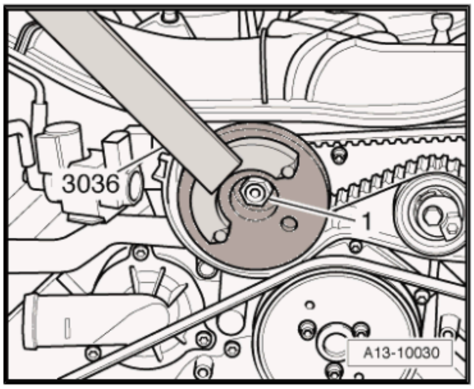
> Caution
>
> *Observe rules for cleanliness when working on the injection system ⇒ page 2 .*

– Remove intake manifold (top section) ⇒ page 20 .

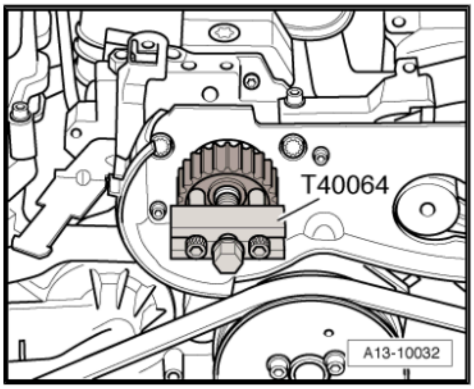
– Remove toothed belt for high-pressure pump.

– Loosen central nut -1- for high-pressure pump shaft using counterhold tool - 3036- .

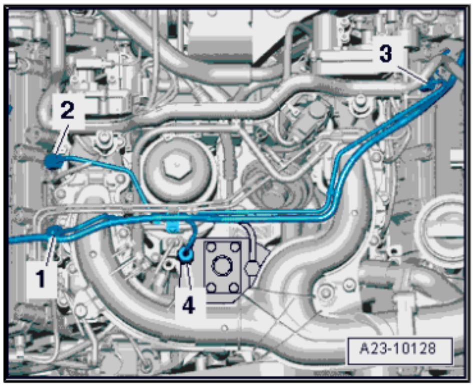
– Remove damper weight.



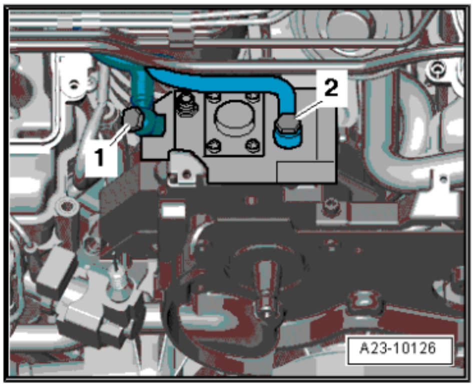
– Use puller - T40064- to pull off belt sprocket for high-pressure pump.



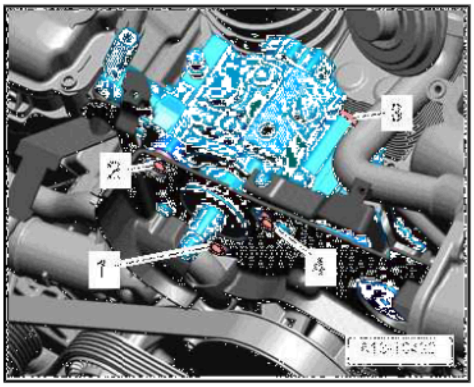
- Unscrew union nuts -1 ... 4- and detach high-pressure pipes.



- Disconnect fuel supply line -2- and fuel return line -1- from high-pressure pump and move lines clear to the side.

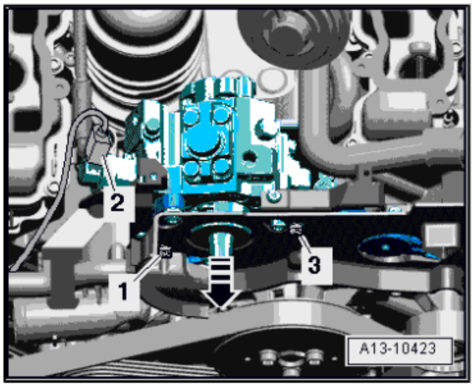


- Unscrew bolts -1 ... 4-.
- Unplug electrical connector -2-.



– Remove bolts -1- and -3-.

– Carefully pull toothed belt cover in direction of -arrow- and lift out high-pressure pump.



Installing

Installation is carried out in the reverse order; note the following:

Caution

The high-pressure pump must first be filled with fuel before the engine is started. The high-pressure pump must not be allowed to run while still empty.

Note

- *Renew seals and gaskets.*
- *Hose connections and hoses for charge air system must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*

– Tighten union nuts on high-pressure pipes hand-tight initially.

– Ensure that high-pressure pipes are not under tension.

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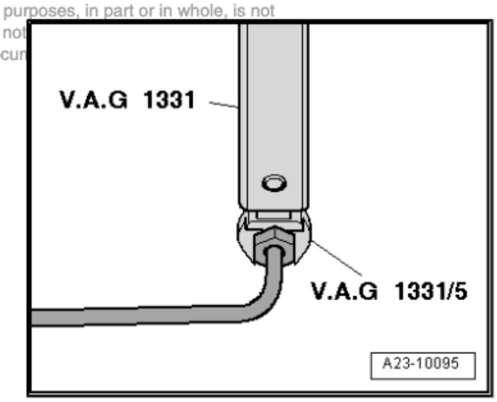
– To tighten unions of high-pressure pipes at rail elements, use torque wrench - V.A.G 1331- with open end spanner insert, AF 19 - V.A.G 1331/5- .

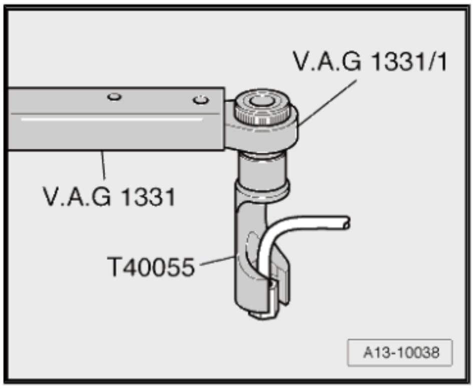


– To tighten union of high-pressure pipe at high-pressure pump, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- , 17 mm.

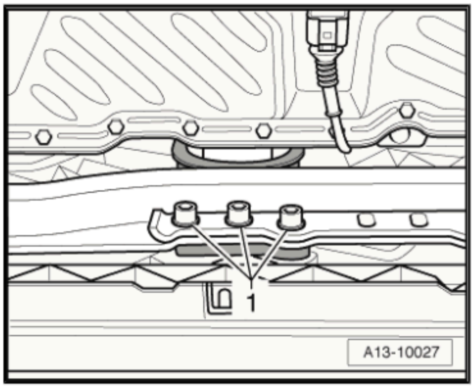
– Install toothed belt for high-pressure pump.

– Install intake manifold (top section) ⇒ page 20 .

– Install lock carrier with attachments ⇒ Rep. gr. 50 .



- Slacken bolts -1-.
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts.
- Install bumper cover (front) ⇒ Rep. gr. 63 .
- Bleed high-pressure pump ⇒ page 83 .
- Check fuel system for leaks.



Tightening torques

Component		Nm
High-pressure pump to front bracket		22
High-pressure pump with front bracket to bracket (rear)		22
Fuel supply and return lines to high-pressure pump		25
Toothed belt cover (rear) to engine		9
Damper weight to high-pressure pump		70
Toothed belt drive sprocket to camshaft		75
High-pressure pipe to high-pressure pump		25
Air pipe (top) to engine		9
Stop for torque reaction support to tubular cross member		40
Hose clips	Width 9 mm	3
	Width 13 mm	5.5

1.31 Bleeding fuel system after installing high-pressure pump

After installation, the high-pressure pump must first be filled with fuel before the engine is started (the pump must not be allowed to run while still empty).

Note

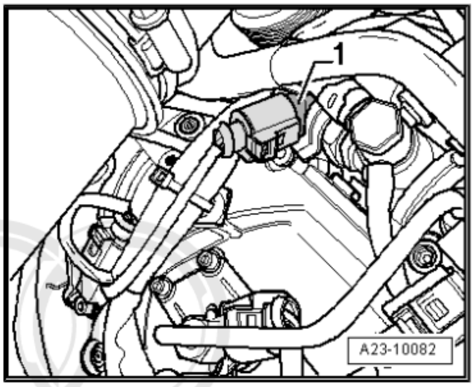
- *When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.*
- *Only remove sealing plugs immediately prior to installation of fuel lines.*
- *There must be sufficient fuel in the tank.*

Bleeding fuel system

Proceed as follows to fill high-pressure pump with fuel.

- Connect battery charger if necessary. ⇒ Electrical system; Rep. Gr. 27; Charging battery

- Unplug connector from fuel pressure regulating valve - N276- so that engine does not start when starter motor is operated.
- Operate starter motor for 3 x 13 seconds. (Wait approx. 20 seconds each time after operating starter to prevent it from overheating.)
- Re-attach connector on fuel pressure regulating valve - N276- .
- Erase fault in fault memory using diagnostic tester.
- Start engine.
- After bleeding fuel system, leave engine running at moderate speed for a few minutes and then switch off again.
- Check fuel system for leaks.
- After completing the repair, road-test the vehicle over a distance of at least 20 km. Accelerate with full throttle at least once. Then inspect the high-pressure section of the fuel system again for leaks.



Note

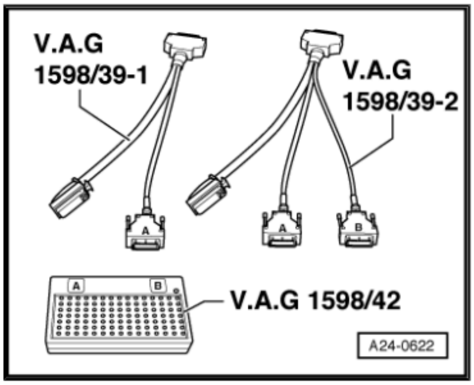
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

- Interrogate fault memory.

1.32 Wiring and component check with test box - V.A.G 1598/42-

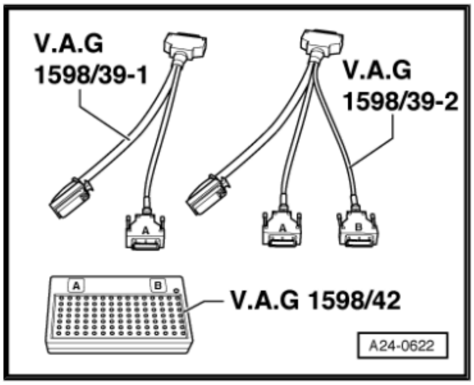
Special tools and workshop equipment required

- Adapter cable - V.A.G 1598/39-1-
- Adapter cable - V.A.G 1598/39-2-
- Test box - V.A.G 1598/42-



Note

- *Persons wearing a pacemaker should not lean over the engine compartment while the engine is running, as the injectors use high voltage pulses.*
- *The test box has 105 contacts. The connecting cable can be disconnected from the test box. This means that only the cable (and not the test box) has to be purchased for future engine control units with different types of connectors.*
- *The smaller of the two connectors on the engine control unit has the contacts 1 to 60. The larger of the two connectors has the contacts 1 to 94.*
- *To carry out tests on the 60-pin wiring harness connector, the adapter cable - V.A.G 1598/39-1- is connected to connector "A" on the test box. For components connected to 60-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- *To carry out tests on the 94-pin wiring harness connector, the adapter cable - V.A.G 1598/39-2- must be connected to connectors "A" and "B" on the test box. For components connected to 94-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- *The test box - V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time.*
- *The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).*
- *The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.*

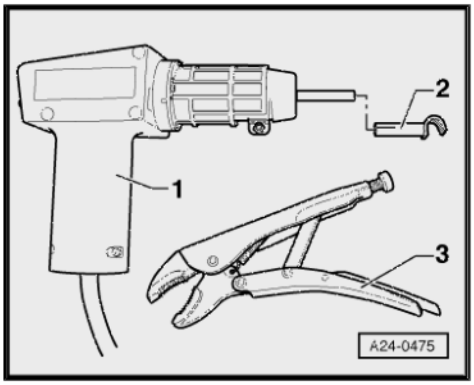


Caution

To prevent irreparable damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

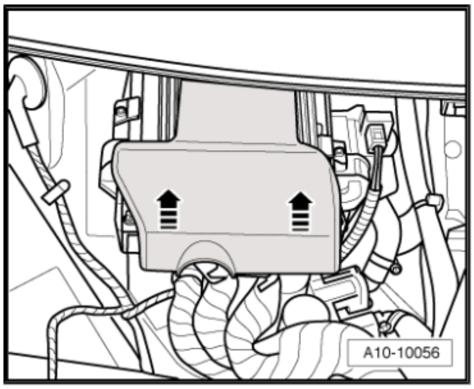
Special tools and workshop equipment required

- Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-
- Small, commercially available mole grips -3-



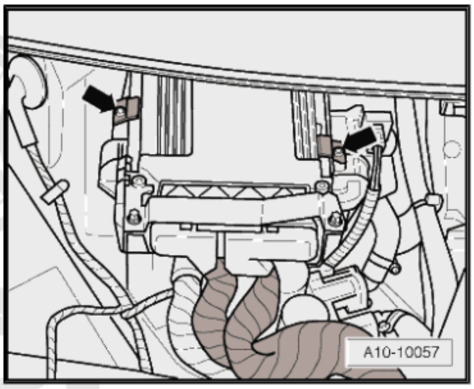
Procedure

- Switch off ignition.
- Remove cover from plenum chamber (right-side).
- Detach cover above engine control unit -arrows-.



To help prevent unauthorised access to the connectors on the engine control unit, the control unit is secured by means of shear bolts to a locking plate and a metal casing.

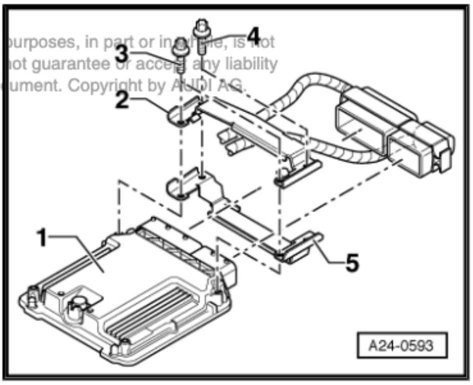
- Remove bolts -arrows-.



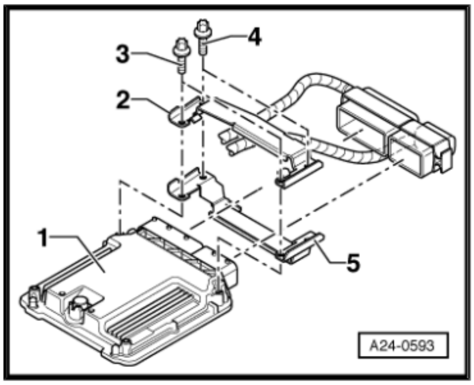
Remove retaining clip and engine control unit from electronics box (plenum chamber).

Note

Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/gearbox combination.

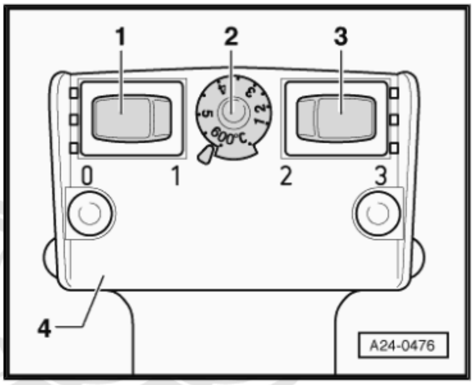


The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.



The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.

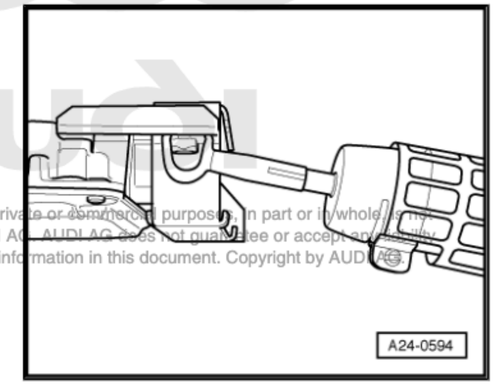
- Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.

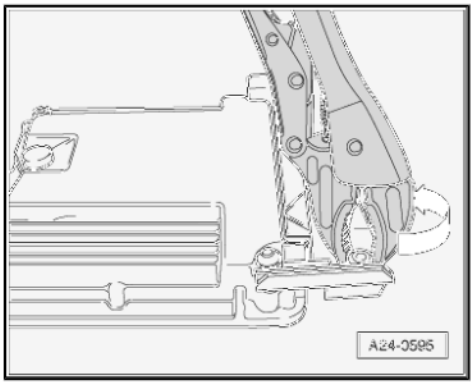


WARNING

Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

- Apply heat to the threads of the shear bolts on the connector side as shown in the illustration for approx. 25 to 30 seconds.





- Unscrew shear bolts using mole grips (see arrow in illustration).
- Unscrew shear bolts using mole grips (see arrow in illustration).
- The two shear bolts screwed into the control unit do not need to be heated. They should be removed without being heated.
- Detach metal locking plate from connectors.
- Release connectors on diesel direct injection system control unit - J248- and unplug connectors.
- Connect test box - V.A.G 1598/42- to wiring harness connector. The earth clip on the test box must be connected to the negative battery terminal. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in appropriate repair procedures.

Installing engine control unit

Installation is performed in the reverse sequence.

- Make sure you fit metal casing back on engine control unit.
- Always use new shear bolts.
- Clean threaded holes for new shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Interrogate and, if necessary, erase fault memory. Vehicle diagnostic, testing and information system - VAS 5051B-

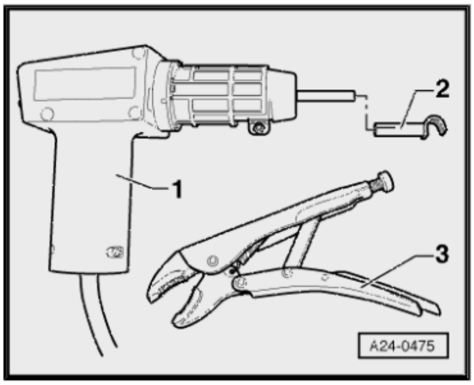
Note

After completion of the Guided Fault Finding routine, the tester will attempt to erase the fault memories of all control units. If this is not successful, the remaining faults registered in the memories must be rectified until all faults can be erased.

1.33 Renewing diesel direct injection system control unit - J248-

Special tools and workshop equipment required

- Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-
- Small, commercially available mole grips -3-



Caution

The engine control unit must be matched to the glow plugs.

An engine control unit with software adapted to the Bosch ceramic glow plugs may only be installed in a vehicle with Bosch ceramic glow plugs.

An engine control unit with software adapted to the Beru metal glow plugs may only be installed in a vehicle with Beru metal glow plugs.

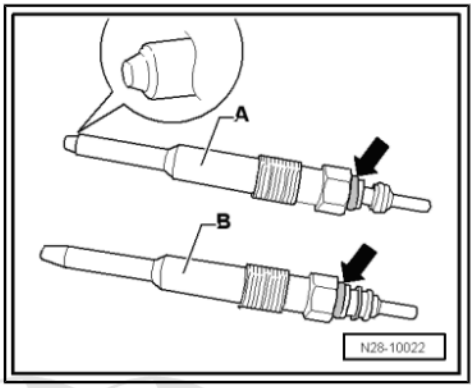
Check whether Bosch or Beru glow plugs are installed in the vehicle.

The glow plugs will be irreparably damaged when the ignition is switched on if the control unit does not have the CORRECT SOFTWARE for the glow plugs.

If the ceramic glow plugs (Bosch) have been replaced with metal glow plugs (Beru) the software of the engine control unit must be flashed accordingly before connecting the glow plug connectors. If this is not done, the metal glow plugs will be IRREPARABLY DAMAGED when the ignition is switched on.

Note

- *Ceramic glow plugs were only installed in model years 2004 and 2005.*
- *Identification of glow plugs:*
- *Ceramic glow plugs -A- are colour-coded with a “white seal” -arrow- and have a chamfered shoulder at the tip.*
- *Metal glow plugs -B- are colour-coded with a “red seal” -arrow-.*



– The adaption values of the injectors must be stored before removing engine control unit - J623- .

Removing

The adaption values for the injectors in the old (defective) engine control unit can be read via Guided Fault Finding or Guided Functions and can be stored as an electronic file in the tester.

– Enter correct vehicle identification in Guided Fault Finding.

– Press “Go to” button.

– Press “Function/component selection”.

– Select “Drive train”.

– “01 - Self-diagnosis compatible systems”

– “01 - Engine electronics”

– Select “Functions”.

– Select “J248 Injector delivery calibration (quantity adjustment) with injector voltage calibration (ISA/IVA)”

Note

If the adaption values of the injectors of the old (defective) engine control unit cannot be read out, the adaption values must be entered into the new engine control unit manually and the adaption procedure must be performed accordingly.

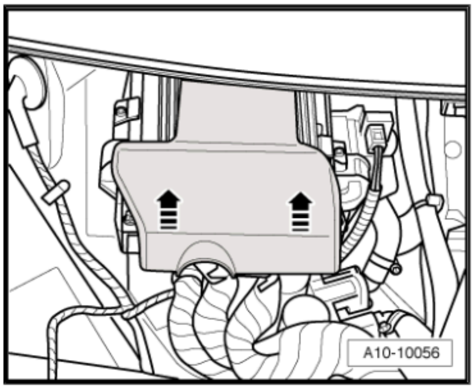
– Switch off ignition after storing file containing adaption values.

– Switch off ignition.

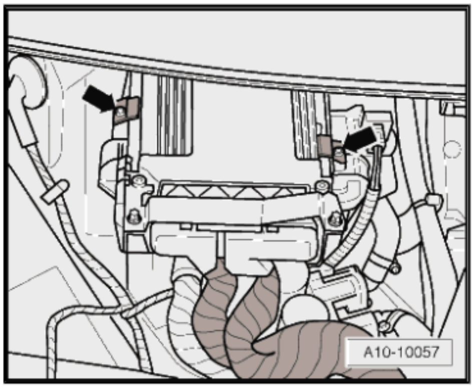
– Remove cover from plenum chamber (right-side).

– Detach cover above engine control unit -arrows-.

To help prevent unauthorised access to the connectors on the engine control unit, the control unit is secured by means of shear bolts to a locking plate and a metal casing.



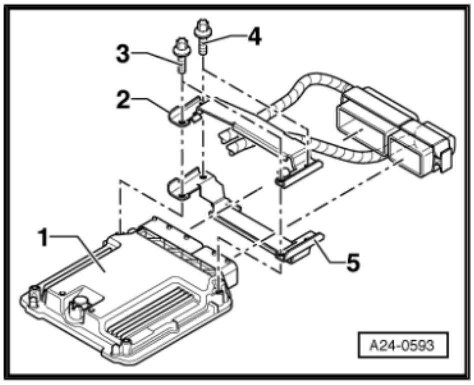
– Remove bolts -arrows-.



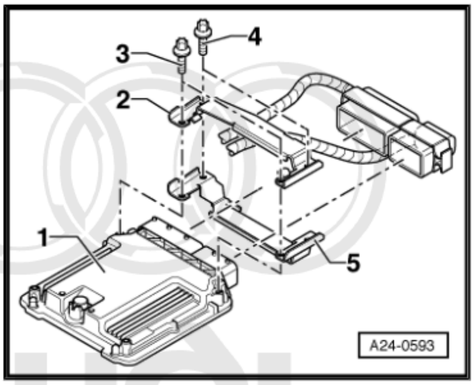
Remove retaining clip and engine control unit from electronics box (plenum chamber).

Note

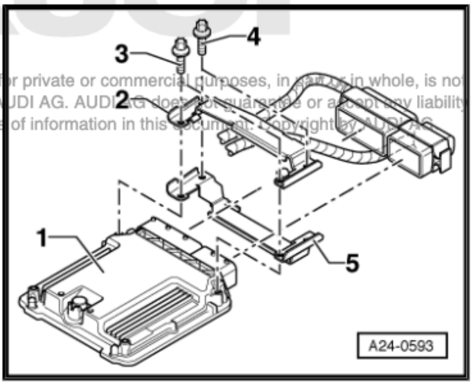
Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/ gearbox combination.



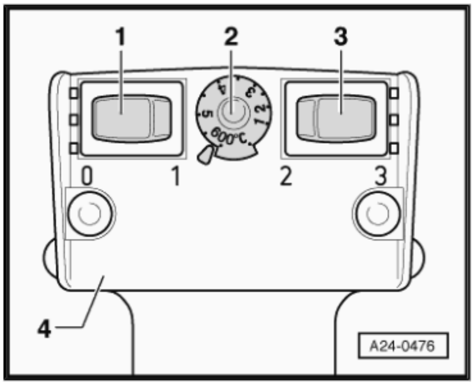
The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.



The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.

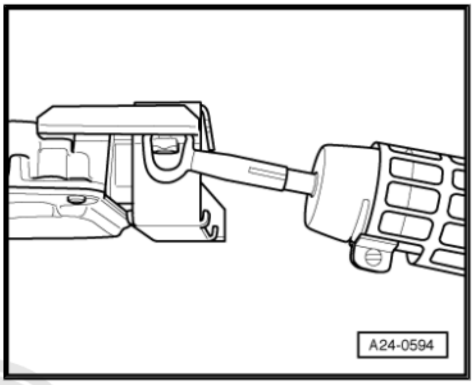


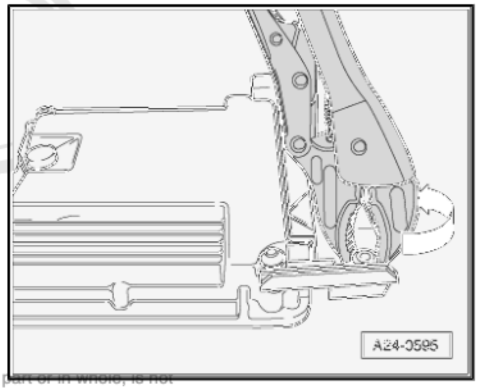
Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



> WARNING
>
> *Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.*

Apply heat to the threads of the shear bolts on the connector side as shown in the illustration for approx. 25 to 30 seconds.





- Unscrew shear bolts using mole grips (see arrow in illustration).
- The two shear bolts screwed into the control unit do not need to be heated. They should be removed without being heated.
- Detach metal locking plate from connectors.
- Remove two bolts securing diesel direct injection system control unit - J248- and pull control unit forwards.
- Release connectors on diesel direct injection system control unit - J248- and unplug connectors.
- Remove old diesel direct injection system control unit - J248- and install new diesel direct injection system control unit - J248- .

Installing

Installation is performed in the reverse sequence.

- After installation, the locking plate must be re-fitted on the diesel direct injection system control unit - J248- .
- Always use new shear bolts.
- After the control unit has been renewed, the injector delivery calibration and the injector voltage calibration must additionally be re-adapted in the diesel direct injection system control unit - J248- (these functions influence engine power and exhaust emissions).
- On vehicles with particulate filter the current mileage (km) reading must be stored in the engine control unit via an adaptation procedure.

The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided Functions.

1.34 Checking fuel pressure regulating valve - N276-

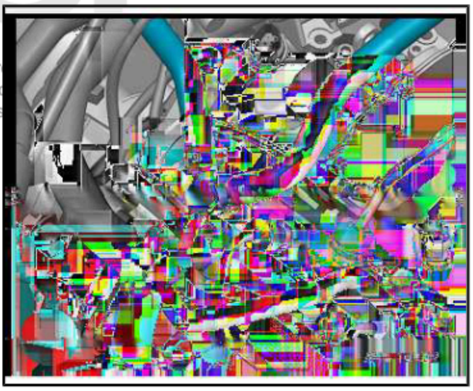
Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

– Remove engine cover panel ⇒ page 14 .

– Disconnect fuel return lines -1, 2 and 3- at banjo bolt.

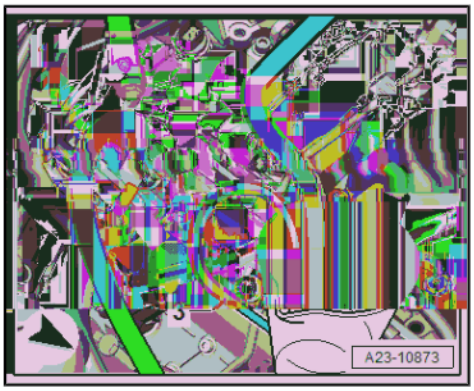


– Seal off open return line connection -1- with plug.

– Seal off open connections at banjo bolt with plugs -arrows-.

– Hold hoses -2 and 3- into a suitable container.

– Attach hose -4- to open connection at banjo bolt.



– Hold hose -4- into a suitable measuring container.

– Measure return flow rate of hose -4- as follows.

Note

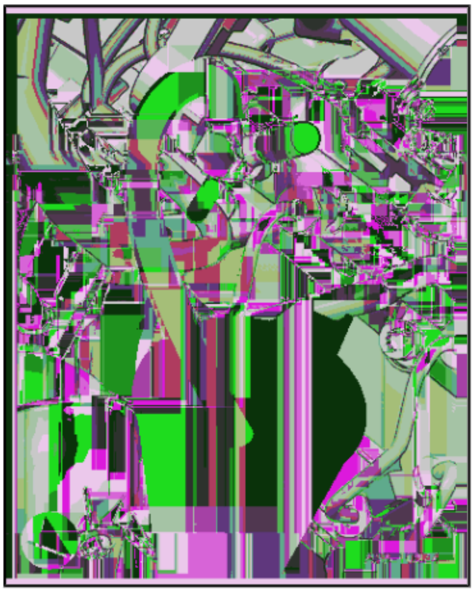
- *Return flow rate from hoses -2 and 3- can be disregarded for this test.*
- *Fuel temperature above 10 °C.*

– Start the engine and run at idling speed.

- Return flow rate from hose -4- (engine start): 0 ml
- Return flow rate from hose -4- after 2 minutes: 50 ml

If specification is not obtained, fuel pressure regulating valve - N276- is defective.

– Renew fuel pressure regulating valve - N276- ⇒ page 94 .



1.35 Removing and installing fuel pressure regulating valve - N276-

Special tools and workshop equipment required

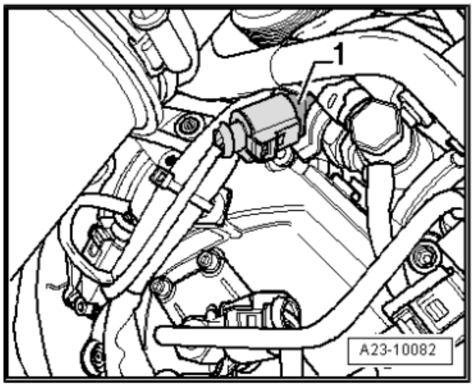
- Torque wrench
- Open-end spanner insert, 30 mm
- Pliers (e.g. water pump pliers)

The fuel pressure regulating valve - N276- -1- is located in the right-side fuel rail (cylinder bank 1). It maintains a constant pressure in the rail and the injector pipes (high-pressure fuel circuit).

If the pressure in the high-pressure fuel circuit is too high, the regulating valve opens to allow some of the fuel to flow back from the rail to the fuel tank via a return line.

If the pressure in the high-pressure fuel circuit is too low, the valve closes and seals off the high-pressure section of the system from the low-pressure section.

The fuel pressure regulating valve - N276- cannot be re-used.



Removing

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

- Remove engine cover panel ⇒ page 14 .
- Before removal, clean area around thread for fuel pressure regulating valve using commercial cleaning solution etc. (no dirt must enter the bore in the rail element).

Note

Clean carefully; cleaning solution must not enter the electrical connector.

- Unscrew banjo bolt for fuel return lines.
- Dry off fuel pressure regulating valve - N276- .
- Remove banjo bolt for fuel return lines (make sure that all parts are clean).
- Detach electrical connector at fuel pressure regulating valve - N276- .
- Slacken union nut (counterhold at hexagon flats on housing). Then unscrew and remove by hand.
- Extract dirt from opening in rail (threads and sealing surface). Do not use metal tools, etc.

Note

Seal off opening in rail immediately with a suitable plug to prevent dirt from entering.

Installing

Note

- *The fuel pressure regulating valve - N276- has a deformable sealing lip and no separate seal; it can therefore be used only once.*
- *Check that sealing surfaces (deformable sealing lip) and threads on new fuel pressure regulating valve - N276- are not damaged.*
- *Check sealing surface at opening in rail.*
- *Thread on fuel pressure regulating valve - N276- must be free of oil and grease.*

- Screw on union nut by hand.
- Align regulating valve so that connecting wire is free of tension after connector is attached.
- Hold regulating valve in this position by holding hexagon flats on housing of regulating valve with pliers (water pump pliers or similar).
- Use suitable torque wrench with an open-end spanner insert (30 mm) to tighten union nut.

Note

- *There are different tightening torques for vehicles manufactured »before« November 2005 and for vehicles manufactured »after« November 2005.*
- *To find out whether the vehicle was manufactured before or after November 2005: unplug electrical connector from throttle valve module - J338- and count the pins.*
- *4 pins = manufactured before November 2005*
- *5 pins = manufactured after November 2005*

Tightening torques for vehicles manufactured before November 2005

Tighten union nut in 2 stages.

Stage 1: 60 +/-5 Nm (counterhold hexagon flats on housing)

Then back off union nut 90° ($^1/_4$ turn; counterhold hexagon flats on housing).

Stage 2: 80 + 5 Nm (counterhold hexagon flats on housing)

Tightening torques for vehicles manufactured after November 2005

Tighten union nut in 2 stages.

Stage 1: 60 +/-5 Nm (counterhold hexagon flats on housing)

Then back off union nut 90° ($^1/_4$ turn; counterhold hexagon flats on housing).

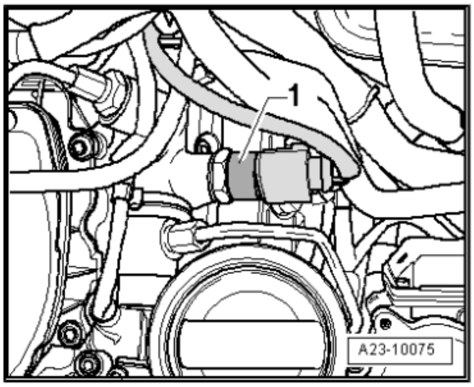
Stage 2: 95 + 5 Nm (counterhold hexagon flats on housing)

- Tighten banjo bolt with new seals.

- Tightening torque: 25 Nm

- After installation, run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Interrogate fault memory.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- Interrogate fault memory again.

1.36 Removing and installing fuel pressure sender - G247-



The fuel pressure sender - G247- (rail pressure sensor) -1- is located in the left-side fuel rail (cylinder bank 2) and continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the diesel direct injection system control unit - J248- .

Should the sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function, allowing a maximum of approx. 3000 rpm.

Removing

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 2 .

Follow these instructions before starting work and while working on the fuel system.

– Remove engine cover panel ⇒ page 14 .

– Before removal, clean area around thread for fuel pressure sender using commercial cleaning solution etc. (no dirt must enter the opening in the rail).

Note

Clean carefully; cleaning solution must not enter the electrical connector.

– Dry off fuel pressure sender - G247- .

– Detach electrical connector at fuel pressure sender - G247- .

– Unscrew and remove fuel pressure sender - G247- .

– Extract dirt from opening in rail (threads and sealing surface). Do not use metal tools, etc.

Note

Seal off bore in rail immediately with a suitable plug to prevent dirt from entering.

Installing

Note

- *The fuel pressure sender - G247- does not have a seal; instead, it has a deformable sealing lip.*
- *Check that sealing surfaces (deformable sealing lip) and threads on fuel pressure sender - G247- are not damaged. If inspection of fuel pressure sender - G247- shows that it is OK, it can be used again.*
- *Also check sealing surface at opening in rail.*
- *The beginning of the thread and the deformable sealing lip of the fuel pressure sender - G247- must be lubricated with Molykote grease.*

– Screw in fuel pressure sender - G247- by hand.

– Then tighten fuel pressure sender - G247- to specified torque.

- Tightening torque: 30 +/-3 Nm

Bleeding fuel system and checking for leaks

– After installation, run engine at moderate speed for several minutes and then switch off.

Note

The fuel system is “self-bleeding”; do NOT open the high-pressure connections.

– Interrogate fault memory and erase, if necessary.

– Switch off ignition.

– Carefully check the entire fuel system for leaks.

Renew the affected component if leakage still occurs after tightening to the correct torque.

– After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

Note

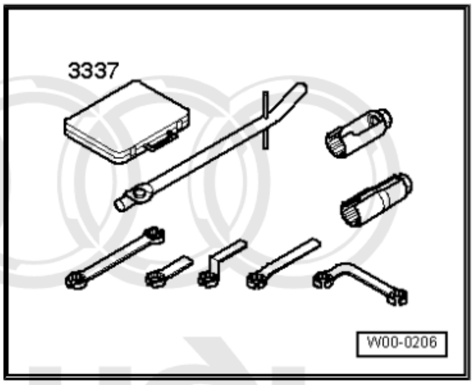
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the fault memory. Then continue the road test.

– After road test interrogate the fault memory again.

1.37 Removing and installing Lambda probe - G39- with Lambda probe heater - Z19-

Special tools and workshop equipment required

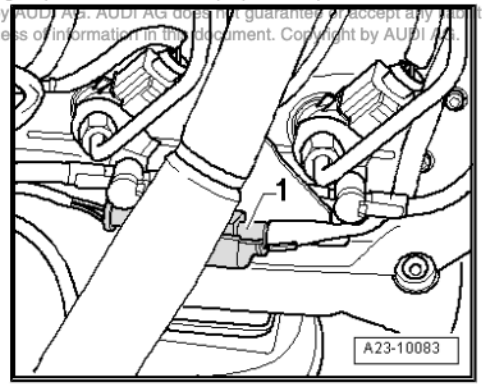
- Lambda probe open ring spanner set - 3337-



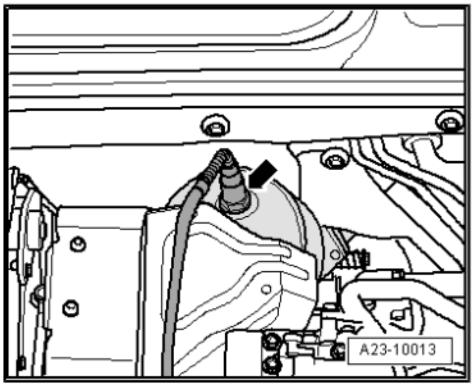
Removing

– Remove engine cover panel ⇒ page 14 .

– Unplug electrical connector -1- for Lambda probe.



– Unscrew Lambda probe using tool from Lambda probe open ring spanner set - 3337- .



Installing

When installing, note the following:

Note

- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with an assembly paste (high-temperature paste). For high-temperature paste refer to ⇒ Parts catalogue .*
- *The paste must not get into the slots on the probe body.*
- *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- *Tightening torque: 55 Nm*

1.38 Removing and installing exhaust gas pressure sensor 1 - G450-

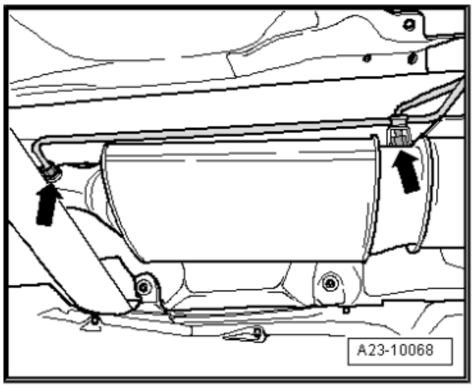
Exhaust gas pressure sensor 1 - G450- is only installed on vehicles with particulate filter.

Exhaust gas pressure sensor 1 - G450- is connected via two pipes -arrows- to the take-off points upstream and downstream of the particulate filter.

Exhaust gas pressure sensor 1 - G450- detects the amount of deposits in the particulate filter.

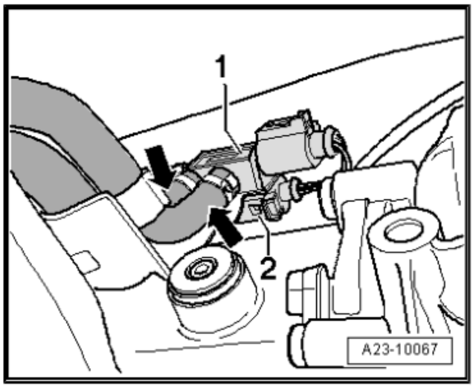
Removing

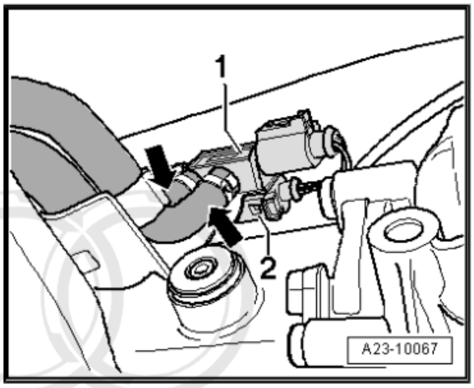
– Exhaust gas pressure sensor 1 - G450- -1- is mounted on gearbox (right-side).



– Before disconnecting, spray the two hoses -arrows- with suitable release agent.

– Carefully pull hoses off connections (take care to keep the hoses straight; the connections can easily break off exhaust gas pressure sensor 1 - G450-).





- Detach electrical connector from exhaust gas pressure sensor 1 - G450- -1-.
- Unscrew the two bolts and remove exhaust gas pressure sensor 1 - G450- .

Installing

- When installing, note the following:

Note

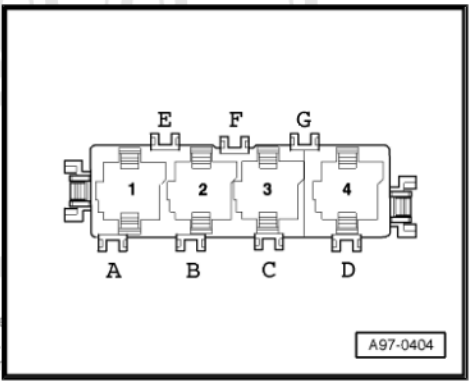
- *Before installing, blow out hoses for exhaust gas pressure sensor 1 - G450- towards particulate filter with compressed air (hoses can become obstructed or may ice up due to condensation).*
- *Make sure that hoses are securely fitted and seal properly.*
- *Tightening torque: 3.5 Nm*
- *If pressure connections are detached from particulate filter, tighten to 30 Nm.*

Adaption must be performed after renewing exhaust gas pressure sensor 1 - G450- and/or particulate filter. (The procedure is described under Guided Functions.)

- Enter correct vehicle identification in Guided Fault Finding.
- Press “Go to” button.
- Press “Function/component selection”.
- Select “Drive train”.
- “01 - Self-diagnosis compatible systems”
- “01 - Engine electronics”
- Select “Functions”.
- “Adapt particulate filter learned values”

28 – Glow plug system

1 Checking glow plug system



Automatic glow period control unit - J179- is located in relay and fuse holder (in electronics box in plenum chamber).

3 - Automatic glow period control unit - J179-

B - Glow plug fuse

The glow plug system is activated via the automatic glow period control unit - J179- . The automatic glow period control unit - J179- is capable of self-diagnosis. A fault is stored in the engine control unit if a fault occurs in the glow plug system.

The procedure for checking the glow plug system is described in the Guided Fault Finding.

For faster starting, the vehicle is equipped with electronically controlled glow plugs and a separate glow period control unit. The ceramic glow plugs require extra care when handling.

The individual glow plugs (metal or ceramic) are activated and diagnosed separately.

The ceramic glow plugs require extra care when handling.

The individual glow plugs (metal or ceramic) are activated and diagnosed separately.

Note

- *Wait for 60 seconds each time after performing final control diagnosis of the glow period control unit. The ignition must remain switched on.*
- *If you do not wait for 60 seconds (if ignition is switched off and immediately switched on again), the glow plugs can be damaged (due to repeated pre-heating).*
- *The activation of the glow plugs is controlled according to coolant temperature.*

1.1 Removing and installing glow plugs

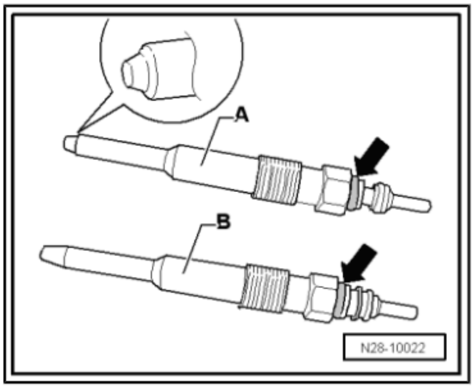
Note

- *Two different types of glow plugs are fitted in the 3.0 ltr. common rail engine: Bosch ceramic glow plugs or Beru metal glow plugs.*
- *Metal glow plugs are always fitted in the 2.7 ltr. common rail engine.*
- *It is very important to use the correct type of glow plugs depending on the software version of the engine control unit, otherwise the glow plugs will be irreparably damaged when the ignition is switched on.*

Identifying the different types of glow plugs for the 3.0 ltr. engine:

A - Ceramic glow plugs are colour-coded with a “white seal” -arrow- and have a chamfered shoulder at the tip.

B - Metal glow plugs are colour-coded with a “red seal” -arrow-.



Caution

Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.

The software of the engine control unit is specifically adapted to either the ceramic or the metal glow plugs, so it is important to install the correct type.

The glow plugs must not be removed when checking cylinder compression. The compression test is performed via the Guided Fault Finding function.

Transport and store only in original packaging or packed separately in bubble wrap.

Do not remove from packaging until immediately prior to installation.

After removal, the cylinder head must not be put down on the gasket side with the glow plugs still installed, because the glow plugs project beyond the gasket surface.

Removing ceramic glow plugs (Bosch)

Caution

Due to the special properties of the material used, the ceramic glow plugs (Bosch type GSK3) are easily damaged and require extra care when handling and installing.

Always install a new ceramic glow plug if you are not sure the old one is in perfect condition.

If a ceramic glow plug has been damaged or the heater pin is broken, this will invariably cause engine damage.

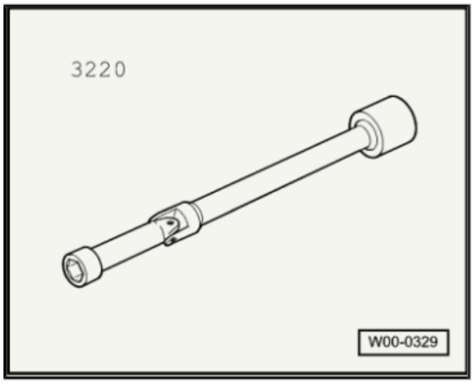
If the heater pin of the glow plug is broken, the fragments must be removed from the engine before starting for the first time, otherwise this will cause mechanical damage (piston seizure). Remove the relevant cylinder head if necessary.

- Before removal, the ceramic glow plugs must be burnt clean using the final control diagnosis function in the diagnostic tester.
- Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.

Note

- *Cleaning procedure:*
- *Use a vacuum cleaner to remove coarse dirt.*
- *Spray brake cleaner or suitable cleaning agent into glow plug openings, let it work in briefly, and blow out with compressed air.*
- *Then clean the glow plug openings using a cloth moistened with oil.*

- When loosening and tightening ceramic glow plugs, use special tool U/J extension and socket, 10 mm - 3220- and a suitable torque wrench.
- Before removing the ceramic glow plugs, always detach any ancillary components which restrict access (e.g. upper and lower sections of intake manifold).
- Unplug the connector from the glow plug to be removed.
- When loosening a ceramic glow plug, do not exceed the “maximum release torque” of 20 Nm. When loosening, always use U/J extension and socket, 10 mm - 3220- and a torque wrench.



Note

- *If the ceramic glow plugs are difficult to remove (release torque more than 20 Nm), use a suitable penetrating oil spray and try again.*
- *If one of the ceramic glow plugs cannot be loosened by applying the maximum release torque of 20 Nm, the cylinder head must first be removed ⇒ Rep. gr. 15 so the glow plug can be unscrewed.*

- Then unscrew the ceramic glow plug carefully by hand or using a suitable length of hose (approx. 25 cm; Part No. N 020 150 5, sold by the metre). Keep the glow plug straight while unscrewing.
- Carefully pull ceramic glow plugs out from above using a suitable tool (such as a length of hose). Take care to prevent glow plugs from contacting other parts.

Installing ceramic glow plugs

Caution

IMPORTANT: always observe the precautions listed above.

The threads in the cylinder head and on the ceramic glow plugs must be dry, and free of oil and grease.

Note

Before installing glow plugs, clean combustion deposits out of glow plug openings in cylinder head.

- Screw in ceramic glow plugs finger-tight.

It is important to keep to the specified tightening torque for glow plugs: “12 Nm” (threads dry and free of oil and grease). The heater pins of the glow plugs can break if this torque setting is not observed, which invariably causes engine damage.

- Check function of ceramic glow plugs after installation and before starting engine for the first time.

After installation, check electrical resistance directly at glow plug contacts: not greater than 1 Ohm

- If this specification is not obtained (resistance greater than 1 Ohm), remove defective ceramic glow plug again and check whether heater pin is broken. If a broken heater pin is visible, it is very important to remove the fragments from the engine before starting for the first time. Remove cylinder head if necessary, otherwise this will result in mechanical damage to the engine.
- Reconnect electrical connectors on ceramic glow plugs. Make sure that connector engages properly.
- Install any ancillary units that were previously detached.

Additionally check ceramic glow plugs via self-diagnosis.

- Erase fault memory of engine control unit. Do not start engine at this stage.
- Perform final control diagnosis (automatic glow period control unit - J179-).
- Interrogate fault memory again. Do not start engine at this stage.
- The engine must not be started if the fault memory has registered a fault relating to the ceramic glow plugs. Check electrical connectors and renew relevant ceramic glow plug if necessary.

Removing metal glow plugs (Beru)

Caution

Mixed installation of ceramic glow plugs and metal glow plugs on the same engine is not permissible.

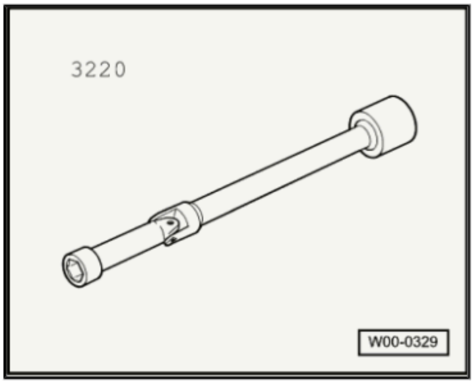
- Switch off ignition.
- Detach glow plug connectors from glow plugs which are to be removed.
- Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.

Note

- ♦ *Cleaning procedure:*
- ♦ *Use a vacuum cleaner to remove coarse dirt.*
- ♦ *Spray brake cleaner or suitable cleaning agent into glow plug apertures, let it work in briefly, and blow out with compressed air.*
- ♦ *Then clean the glow plug openings using a cloth moistened with oil.*

- Before removal, always detach any ancillary components which restrict access.

- To slacken the glow plugs use special tool U/J extension and socket, 10 mm - 3220-



Installing metal glow plugs

- Before installing glow plugs, clean out combustion deposits from glow plug bores in cylinder head.
- To tighten the glow plugs use special tool U/J extension and socket, 10 mm - 3220- with a suitable torque wrench.
- Tighten glow plugs.

◆ Tightening torque: 17 Nm

> Caution
>
> *If the ceramic glow plugs (Bosch) have been replaced with metal glow plugs (Beru) the software of the engine control unit must be flashed accordingly before connecting the glow plug connectors. If this is not done, the metal glow plugs will be IRREPARABLY DAMAGED when the ignition is switched on.*

- Attach glow plug connectors correctly and make sure they are securely fitted.
- Install any ancillary units that were previously detached.